Biological Assessment
For
Enhanced Habitat Protection and Reduction in Colorado River Flows Between Hoover Dam and Parker Dam in Excess of Flow-Related Covered Actions and Activities Provided Under the Lower Colorado River Multi-Species Conservation Program

Bureau of Reclamation
Lower Colorado River Multi-Species Conservation Program

March 2022

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Proposed Action

The Bureau of Reclamation (Reclamation), through this Biological Assessment (BA), is requesting consultation on the following actions: (1) Increasing the amount of reduction in flow coverage provided under the Lower Colorado River Multi-Species Conservation Program (LCR MSCP) in Reaches 2 and 3 (from Hoover Dam to Parker Dam) up to 1.574 million acre-feet per year (afy), from the current coverage of 845,000 and 860,000 afy, respectively; and (2) Implementing proposed conservation measures, including habitat creation, management, and protect, as an integral part of the proposed action to fully offset the potential effects to species and their habitats associated with the requested increases in flow reductions.

Program Background and Introduction

The Lower Colorado River Multi-Species Conservation Program (LCR MSCP) is a 50-year, federal/non-federal partnership among 56 entities that provides Endangered Species Act (ESA) compliance for on-going and future operations and maintenance activities on the lower Colorado River from April 2005 through April 2055. The Secretary of the Interior approved the LCR MSCP and authorized Reclamation's participation in a Record of Decision dated April 2, 2005. The Record of Decision incorporated a number of Program Documents to guide implementation of the Program over its 50-year term.[1] Congress subsequently recognized the Secretary's authority "to manage and implement the LCR MSCP" in accordance with the relevant program documents in the Omnibus Public Land Management Act of 2009, (Pub. L. No 111-11, Tit. IX, Subtitle E, at 123 Stat. 1327-29). The LCR MSCP has been implemented in full compliance with the Program Documents for the past 17 years.

The LCR MSCP planning area extends from full pool elevation of Lake Mead to the Southerly International Border with Mexico, spanning over 400 miles and encompassing portions of seven counties in the three Lower Basin States of Arizona, California, and Nevada. Consistent with the Program Documents, the Bureau of Reclamation (Reclamation) is the implementing agency for the LCR MSCP and is responsible for completing conservation measures described in the Habitat Conservation Plan and Reasonable and Prudent Measures in the Biological Opinion. Reclamation interacts with its partners through the LCR MSCP Steering Committee, which is comprised of state and Federal agencies, regional water and power users, municipalities, Native American tribes, and conservation organizations, among others, who provide collaborative input and oversight functions in support of LCR MSCP implementation.

The LCR MSCP is a unique program created to meet the need for a comprehensive species conservation program on the Lower Colorado River (LCR) that could address broad and long-term issues related to water and power activities. The water management functions of

[1] "PROGRAM DOCUMENTS.—The term ''Program Documents'' means the Habitat Conservation Plan, Biological Assessment [BA] and Biological and Conference Opinion [BiOp], Environmental Impact Statement/Environmental Impact Report [EIS/EIR], Funding and Management Agreement [FMA], Implementing Agreement [IA], and Section 10(a)(1)(B) Permit [Permit] issued and, as applicable, executed in connection with the LCR MSCP, and <u>any amendments or successor documents that are developed consistent with existing agreements and applicable law</u>." Pub. L. No. 111-11 at § 9401(3) (emphasis added).

Reclamation on the LCR are implemented in accordance with a suite of compacts, laws, rules and regulations, and operating criteria commonly referred to as the “Law of the River.” As set forth in detail in the LCR MSCP Program Documents, many activities along the LCR, especially those relating to water delivery and diversions, involve discretionary and non-discretionary actions[2], both federal (e.g., facilities operations at major Colorado River reservoirs) actions and non-federal activities (e.g., water orders pursuant to existing agreements and contracts), and are interrelated and interdependent; these actions are coordinated to such an extent that attempting to separate out the effects of all relevant actions and activities and assigning each to a particular Federal or non-Federal agency was not found to be feasible or the optimal approach to species conservation by Reclamation and the U.S. Fish and Wildlife Service and confirmed by the Secretary of the Interior as set forth in the LCR MSCP Record of Decision and supporting documentation. Given this consolidation of Federal actions and non-Federal activities on the LCR, it is not clear which parties could have specific responsibility under the ESA for any potential take of ESA-listed species. The LCR MSCP therefore integrates Section 7 and Section 10 responsibilities under the ESA, with no functional separation of effects and the resultant incidental take for the Federal and non-Federal covered actions. Subsequently, Congress authorized the Secretary to implement the Program accordingly under Public Law No. 111-11, as discussed above. The Program also utilized habitat impacts as a proxy for species impacts, as direct species effects were difficult to accurately and appropriately quantify. This was done through the creation of a modeling process that relates habitat extent to specific hydrologic changes resulting from flow-related covered activities. Conservation measures were then developed from the results of this modeling.

As a 50-year program that covers a wide variety of activities, the LCR MSCP provided coverage for a broad range of foreseeable future activities at the time the program was formally adopted in 2005. The past seventeen years of Program implementation have affirmed the importance of the flexible and forward-looking program coverage contained in the Program Documents. Nothing in this BA changes in any fashion, the existing, binding commitment of the federal and non-federal LCR MSCP parties to fully implement the Program through 2055.

The LCR MSCP parties hold a Section 10 Permit and, accordingly are referred to as non-federal permittees, as appropriate given the context, in this BA. The approach to initiation of Section 7 consultation set forth in this BA was developed after discussion with members of the LCR MSCP Steering Committee and LCR MSCP program participants; and with technical assistance and informal consultation with the U.S. Fish and Wildlife Service.[3]

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[2] As set forth in the 2004 Biological Assessment, in many cases, a nondiscretionary Federal action is triggered by a state or other non-Federal action. For example, the normal delivery of 7.5 million acre-feet (maf) annually to water contractors in Arizona, California, and Nevada pursuant to the Decree includes a nondiscretionary Federal component (storage and delivery), a discretionary Federal component (diurnal water releases), and may include a non-Federal component (e.g., the request for and diversion of water by a contractor).

[3] The Congressional definition of “Program Documents” contemplated that “successor agreements” would be contemplated during implementation of the Program. This BA and resulting consultation documents (such as a resulting Biological Opinion) are intended to constitute such a successor agreement in that it supplements but does not expressly modify any current Program Document.

Purpose and Need for this Biological Assessment

The next section provides an explanation and the framework for submission of this BA to facilitate important water conservation actions that are designed to minimize the risk of the ongoing historic drought in the Colorado River Basin causing Lake Mead to decline to levels that would significantly threaten water deliveries to water users in Arizona, California, Nevada, and the Republic of Mexico. A precipitous decline in Lake Mead elevation could also adversely impact species present in Lake Mead and in downstream riparian and aquatic areas.

Framework & Rationale for Initiation of Section 7 Consultation pursuant to this Biological Assessment

Among the listed actions and activities identified in the Program Documents, the LCR MSCP provides coverage for flow-related activities including power production and changes to the points of diversion of Colorado River water and associated reduction in water releases from Hoover, Davis and Parker dams. Reductions in flow of 845,000 acre-feet per year (afy) below Hoover Dam (Reach 2), 860,000 afy below Davis Dam (Reach 3) and 1,574,000 afy below Parker Dam to Imperial Dam (Reaches 4 and 5) are currently covered under the LCR MSCP (Figure 1).

Since the start of implementation of the LCR MSCP in 2005, the types of water projects and transactions have expanded. In addition to transfers from one water user to another, as initially contemplated in the LCR MSCP, multiple innovative water conservation mechanisms have been put in place to allow for water to be stored or contributed to Lake Mead for the purpose of protecting Lake Mead elevation in light of the ongoing historic drought in the Colorado River Basin. The successful implementation of these water conservation actions has been essential to protecting water supplies in recent years especially given the extended drought and low-runoff conditions. The importance of these efforts cannot be overstated: Since 2007, these efforts have provided for about 60 feet of conservation in Lake Mead. Absent these efforts, water supplies would have been reduced over the past six years (correlating to the 1075' elevation on the graph), with associated impacts to agricultural, urban and environmental water needs (figure 2).

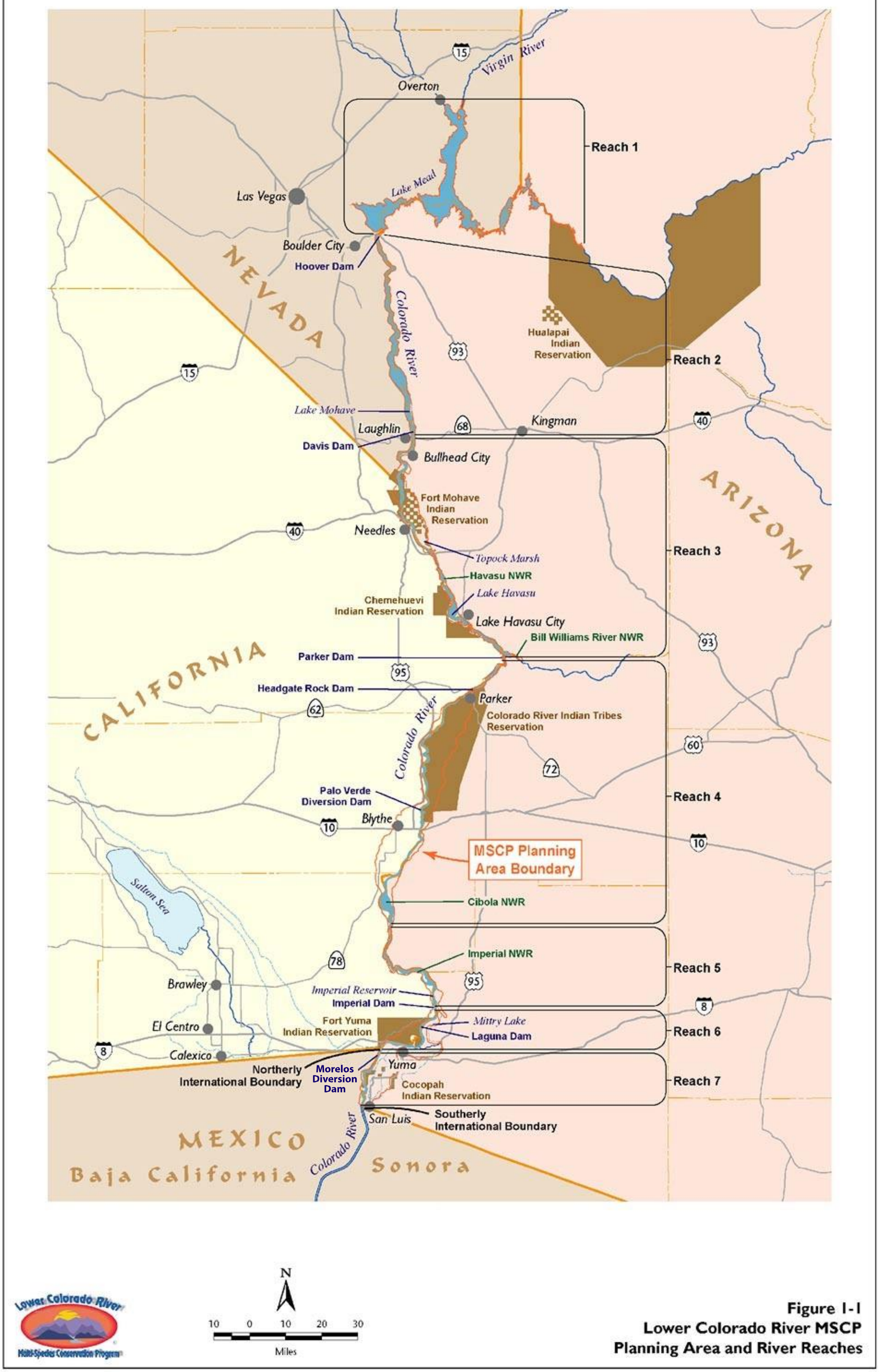

Figure 1-1
Lower Colorado River MSCP
Planning Area and River Reaches

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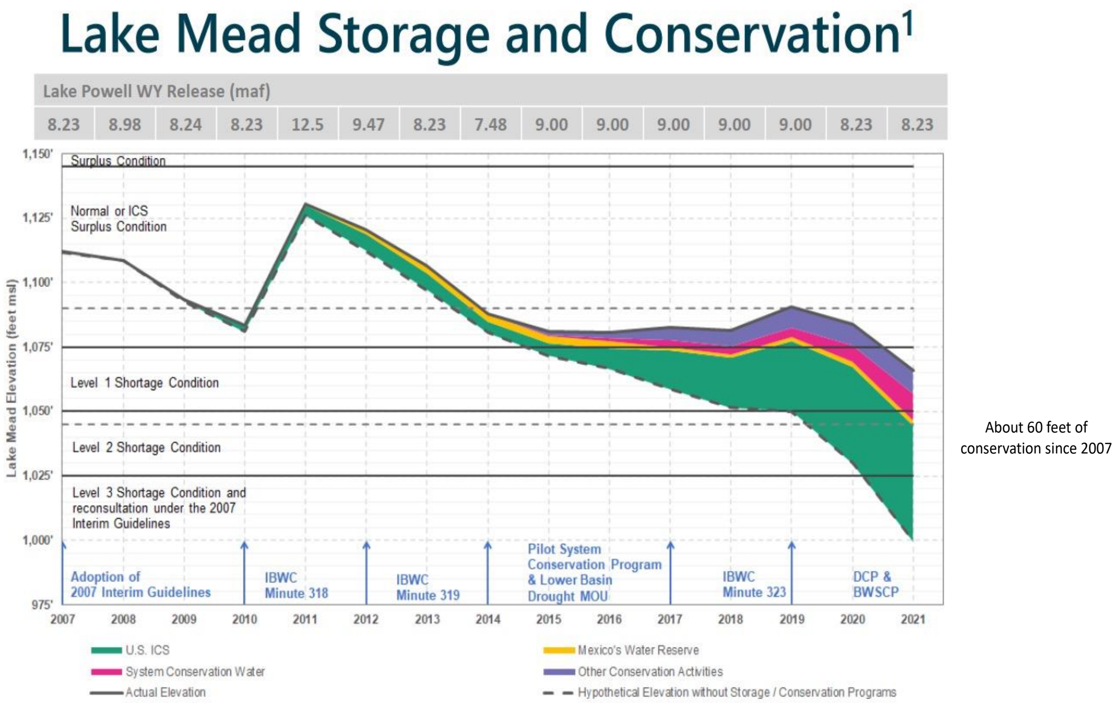

[1]End of calendar year 2021 balances of U.S. ICS and Mexico's Water Reserve, system conservation water, and other voluntary contributions to Lake Mead are based on projections from the September 2021 24-Month Study and are subject to change.

Given the success of these water conservation efforts, and the recent rapid decline in key Colorado River reservoirs including Lake Mead, the Bureau of Reclamation and the LCR MSCP partners are planning to use these mechanisms (voluntary, compensated reductions in water use) to address current and near-term risks resulting from climate change and extended drought. Water conservation plans and efforts increased rapidly during the historically low runoff conditions experienced in calendar year 2021. On August 16, 2021, Reclamation released the Operations Plan for Colorado River System Reservoirs, August 2021 24-Month Study. In addition to projecting Lake Mead elevations to be less than 1,075 feet on January 1, 2022, triggering the first Tier 1 Shortage reduction in the Lower Basin in history (under the 2007 Interim Guidelines),[4] the Minimum Probable projection showed Lake Mead falling below 1,030 feet during the succeeding two-year period. At this elevation Lake Mead contains only approximately 5.6 million acre-feet – a mere 22% of the full capacity of Lake Mead – and would place system users at excessive risk. As noted above, should Lake Mead decline at a continuing rate without responsive action, lowered levels would significantly threaten downstream water deliveries to water users in Arizona, California, Nevada, and the Republic of Mexico. A precipitous decline in Lake Mead water elevation could also adversely affect species present in Lake Mead and in downstream riparian and aquatic areas.

This projection triggered a mandatory consultation requirement between the United States and the Lower Basin parties pursuant to the Congressionally approved Colorado River Drought

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[4] 2007 Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powel and Lake Mead.

Contingency Plan.[5] The Lower Basin Drought Contingency Plan Agreement - Exhibit 1 to Attachment B, Section V. B. 2, states - in pertinent part - that the United States and Lower Basin parties are committed:

> "*…to individual and collective action to avoid and protect against the potential for elevations in Lake Mead to decline to elevations below 1,020'"* and,
>
> *"…If any 24-Month Study for the minimum probable inflows projects that Lake Mead will be at or below 1,030' anytime within the succeeding two Years, the Secretary and Lower Division States shall consult and determine what additional measures will be taken."* (1030 Consultation).

Since the triggering of the 1030 Consultation in August 2021, the United States and the Lower Basin parties have been meeting to address the critical water supply situation to identify, develop and implement the additional actions needed beginning in 2022 to protect the 1020-foot mean sea level (msl) elevation at Lake Mead. It is important to note that these contemplated actions are in addition to the reductions and contributions already required under the 2007 Interim Guidelines and the Drought Contingency Plan and related agreements. A series of modeling efforts revealed that at least 500,000 acre-feet or more per year would be needed to be conserved in 2022 and 2023, with a commitment to continued actions from 2024 – 2026, to meet the commitments set forth in the DCP Agreements to protect Lake Mead's elevation from dropping further to critically low-elevations that would place the Lower Basin (and Mexico) at heightened risk of a crisis.

To allow for the increased water conservation in the Lower Colorado River Basin consistent with the requirements under the Drought Contingency Plan and related agreements, Reclamation is seeking to increase the amount of reduction in flow coverage in Reaches 2 and 3 up to 1,574,000 afy, from the current coverage of 845,000 and 860,000 afy, respectively. This increased coverage for reduction in flow would be equivalent to the amount of current coverage in Reaches 4 and 5 and provide equal flexibility for reductions in flow for all reaches of the lower Colorado River. Reclamation is also including conservation measures as part of the proposed action to fully offset the potential impacts to species and habitat (see Attachment 6).

After consulting with the LCR MSCP Program participants and the U.S. Fish and Wildlife Service, Reclamation concluded that pursuing a Section 7 Consultation in accordance with this BA provides the most appropriate mechanism to simultaneously accomplish three mandatory goals:

1) ensure continued full implementation of the Program as an integrated Section 7/Section 10 effort;

2) ensure continued full compliance with the ESA for the needed and essential water conservation actions through an increase in reduction in flow coverage in Reaches 2 and 3 in light of the critically low elevation projections at Lake Mead, and;

[5] Colorado River Drought Contingency Plan Authorization Act, Pub. L. No. 116-14 (April 16, 2019) (133 Stat. 850).

3) ensure the ability to take immediate urgent action to conserve water in 2022 and future years, through the term of the LCR MSCP, to protect Lake Mead.

The proposed water conservation actions that will be facilitated by increased flow related coverage in Reaches 2 and 3 involve Reclamation and non-federal LCR MSCP participants. While proceeding under Section 7(a)(2) of the ESA, Reclamation's analysis contained in this BA addresses all Colorado River mainstem effects of the anticipated federal and non-federal water conservation actions. The LCR MSCP parties intend to seamlessly integrate the habitat protection aspects of the Program's conservation measures through 2055. While not directly utilizing a formal modification of the non-federal participants' Section 10 Permit to address the expanded flow coverage, the non-federal Permittees are treated as applicants[6] in this process and the analysis set forth in this BA addresses any/all potential effects of any actions by the Permittees in furtherance of the water conservation actions required by the Drought Contingency Plan obligation set forth above. The non-federal LCR MSCP parties are aware of this BA, the approach set forth herein, and have either actively supported or not objected to implementation of this BA's proposed conservation measures. Further, after discussions among Reclamation, the non-federal LCR MSCP parties, and the U.S. Fish and Wildlife Service, the approach utilized in this BA: 1) is the most appropriate regulatory approach given the three mandatory goals set forth above, and (2) fully addresses the requirements and obligations of the relevant Section 10 Permit held by the non-federal LCR MSCP parties with respect to the requested change in coverage. It is the intent of Reclamation and the non-federal Permittees that the contact and authorization requirements of the Section 10 Permit be met through this BA and resulting consultation with respect to all effects of the revised Reach 2 and Reach 3 flow coverage modifications.[7]

Land Cover and Species Habitat Models

The 2004 LCR MSCP Biological Assessment (BA) and the 2004 Habitat Conservation Plan (HCP) used a habitat-based approach for compliance with Section 7(a)(2) and Section 10(a)(1)(B), respectively, of the ESA due to uncertainties in quantifying species impacts. To implement this approach, habitat models were developed for the covered species and the results of the application of these models were used in the assessment of impacts.

[6] The members of the LCR MSCP Steering Committee have been notified and Reclamation has not received any objections to the adopted approach contained in this BA. Reclamation intends to fully honor Paragraph 8 of the LCR MSCP Implementing Agreement which provides, in relevant part that in the event of a Section 7 consultation (as this BA is initiating, "Permittees shall be treated as applicants in any such section 7 consultation and be entitled to fully and completely participate in all matters involved in such consultation or re-initiation of consultation." Implementing Agreement at 17 (April 2, 2005). Reclamation does not believe that the flow-related and habitat protection actions set forth in this BA require an amendment as was done previously upon the listing of the northern Mexican gartersnake, given the three primary objectives set forth supra.

[7] See, e.g., NATIVE ENDANGERED SP. HABITAT CONSERVATION PLAN ENDANGERED WILDLIFE Permit Number: TE086834-1 at Section Q-3: "If during the tenure of this Permit, the Covered Activities and/or the extent of the habitat impact described in the LCR MSCP are altered, such that there may be an increase in the anticipated Take of Covered Species, <u>Permittees are required to contact the Service and obtain authorization</u> and/or amendment of this Permit <u>before commencing any activities that might result in Take beyond that described in Chapter 4 of the HCP." (emphasis added). It is the intent of Reclamation and the non-federal Permittees that the contact and authorization requirements of the HCP Permit be met through this BA and resulting consultation with respect to all effects of the revised Reach 2 and Reach 3 flow coverage modifications.</u>

Since most covered species' habitat had not been field delineated in the LCR MSCP planning area, habitat models were based on a land classification system developed by Ohmart and Anderson (1984b) and Younker and Anderson (1986). This land classification system described three main land cover types used by LCR MSCP covered species. These are woody riparian land cover types (including cottonwood-willow and honey mesquite), marsh, and aquatic land cover.

Habitat models were developed for covered species whose habitats could be correlated to the physical and biological attributes associated with each of the LCR MSCP land cover types. The models define habitat for each covered species as the land cover types that would most likely encompass the elements of each covered species habitat, within the river reaches where each species was known or expected to occur, based on known habitat requirements for the species. Additional information on the species habitat models can be found in Section 4.6.2.1 and summarized in Table 4.9 of the 2004 LCR MSCP BA.

The 2004 LCR MSCP effects analysis assumed that all cottonwood-willow land cover that provided covered species habitat would be impacted by the covered activities. Accordingly, increasing the flow reductions in Reaches 2 and 3 would not change the outcome for this land cover type, as it is already being fully mitigated under the 2004 LCR MSCP BA. Additionally, the LCR MSCP Avoidance and Minimization Measure AMM2 ensures the stabilization of water levels in Topock Marsh, so backwater and marsh habitat in this area will not be affected by reductions in flow.

Four LCR MSCP threatened and endangered species that use marsh and aquatic land cover types in Reaches 2 and 3 may be affected by additional reductions in flow coverage. These include the Yuma clapper rail,[8] bonytail, razorback sucker, and northern Mexican gartersnake. Attachment 1 provides the current status of those species in Reaches 2 and 3. LCR MSCP Volume IV – Appendix I contains descriptions of ecological requirements and status of the covered species range wide. Updates to the four species are included in Attachment 2. Attachment 3 reviews the other threatened and endangered species covered by the LCR MSCP and notes why they are not affected by the increase in reduction of river flow.

Analysis of Impacts and Level of Take

This section describes the methodologies used to analyze effects to habitats (as a proxy for effects to species) for covered species from the increase in reduction in flow. The analysis of impacts and level of take described below follow the methods used in the 2004 LCR MSCP analysis to preserve consistency and comparability.

This analysis looks at the incremental change in hydrologic conditions and effects to land cover type and species' habitat from the proposal to increase the reduction in flow coverage between Hoover Dam and Davis Dam (Reach 2) from 845,000 afy to 1,574,000 afy and between Davis Dam and Parker Dam (Reach 3) from 860,000 afy to 1,574,000 afy. The 2004 LCR MSCP reduction in flow is the baseline for this analysis.

[8] Yuma clapper rail (*Rallus longirostris yumanensis*) is also known as Yuma Ridgway's rail (*Rallus obsoletus yumanensis*).

Assessment of the Proposed Action on Hydrologic Conditions in Reach 2

An increase in the reduction of flow from 845,000 afy to 1,574,000 afy from Hoover Dam to Davis Dam (Reach 2) is not expected to change reservoir volume or elevation due to the proposed action because of ongoing management as part of the 2004 LCR MSCP baseline. Since the hydrologic impacts of the proposed action in Reach 2 are not expected to affect riverine or reservoir conditions, they were not modeled. This conclusion is consistent with the 2004 LCR MSCP analysis.

Lake Mohave is operated as a re-regulating reservoir to balance water releases from Hoover and Parker Dams while managing Lake Havasu in a way that limits large fluctuations in water levels that could impact the Mark Wilmer Pumping Plant, the W.P. Whitsett Intake Pumping Plant, and Lake Havasu City. Historically, this management led to frequent fluctuations within Lake Mohave. To avoid the potential impacts of water level fluctuations to razorback sucker and bonytail, especially during the critical spawning season, Reclamation exchanged Memorandum with the U.S. Fish and Wildlife Service in 1994 and committed to managing Lake Mohave water surface elevation at 640 feet mean sea level and limit fluctuations to less than two feet in any 10-day period between March 15 and September 1. These management criteria have been implemented since 1994 and are part of the baseline operating conditions.

Since Lake Mohave is a re-regulating reservoir, its primary purpose is not water storage. While water releases from Hoover Dam into Lake Mohave and water releases from Davis Dam out of Lake Mohave fluctuate monthly and annually due to water delivery and power production, ; however, water volumes and elevations do not change a lot during most water years. Over the last 5 years, the difference in annual releases from Davis Dam as compared to Hoover Dam ranged from 95% to 101% of the Hoover releases. Total water releases from Hoover Dam have ranged from 9,614,840 afy to 8,514,582 afy over the last 5 years. Releases from Davis Dam have ranged from 9,308,200 afy to 8,124,499 afy over the same period (Bureau of Reclamation, Colorado River Accounting and Water Use Reports 2016; 2017; 2018; 2019; and 2020). Water reductions covered under the 2004 LCR MSCP have not changed this pattern. In 2019, water reductions covered under the LCR MSCP were the highest since the beginning of the program. The flow reductions in Reach 2 totaled 818,255 afy. At the end of 2019, the water volume in Lake Mohave was 1,000 acre-feet less than the beginning of 2019. Since the total volume in Lake Mohave at the beginning of 2019 was 1,639,000 acre-feet and 8,514,582 acre-feet was released from Hoover Dam into Lake Mohave that year, the change in lake volume was less than 0.001% of the total volume. Any habitat that may have been affected from this change in amount is unmeasurable and it is apparent that management activities limit impacts due reductions in flow.

Marsh land cover type within Lake Mohave is limited to small patches of less than 1 acre, usually associated with small coves exposed to lake fluctuations, wind, and wave action. These areas are less than the minimum patch size nor do they provide the necessary habitat requirements for Yuma clapper rails. Infrequent, small patches of cottonwood-willow land cover type exist in protected coves; however, lake fluctuations limit regeneration of riparian plant species. These areas were accounted for in the 2004 impact analysis. No naturally occurring backwater habitat exists in Reach 2; all existing backwaters were created and managed by Reclamation prior to the LCR MSCP to grow out native fish for stocking into Lake Mohave and to conduct research. These backwaters are disconnected from the lake; native fish are stocked into the backwaters in the spring and recaptured in the fall of the same year for release. Lake Mohave is drawn down each fall by Reclamation to facilitate this process. These backwaters do not meet the criteria for created backwater habitat under the LCR MSCP. They are not impacted by the proposed action.

An increase in the reduction of flow from 845,000 afy to 1,574,000 afy in Reach 2 would not result in a change in management of Lake Mohave so the reservoir volume and elevation is not expected to change from existing conditions due to the proposed action. Additional impacts to razorback suckers or bonytail would not differ from impacts analyzed in the 2004 LCR MSCP BA. The proposed action would not limit Reclamation’s ability to comply with the 1994 Memorandum, which mitigates potential impacts to spawning native fish.

Attachment 4 documents the determination that increased reduction in flow to 1,574,000 afy in Reaches 2 and 3 does not impact the other LCR MSCP river reaches. The focus of the following analysis is on Reach 3.

Assessment of the Proposed Action on Hydrologic Conditions in Reach 3

River flows are affected by the operation of dams for hydropower production. Flows can vary seasonally, daily, and hourly. The 2004 analysis determined that flow reductions would not have a measurable effect on the distribution of daily water releases for hydropower production but would affect the magnitude and/or duration of the high and low hourly releases (LCR MSCP Appendix K.1). The low hourly releases result in a reduction in flow and river stage downstream, thereby reducing the extent of marsh and backwater land cover type. Flow reductions will not have an impact on reservoir elevations in Lake Havasu as the frequency and rate of fluctuations will be the same as baseline conditions.

Modeling data were developed for the 2004 LCR MSCP analysis for flow reductions in three different months: April, August, and December. August was evaluated because backwaters provide cover for juvenile fish during the summer, while December represents the lowest water elevation throughout the year. April was selected because river flows are at their highest and; therefore, backwaters, which are important nursery areas for larval fish, are at their highest water surface elevation and acreage. April also represents the time of new growth and dormancy break for cattails and other marsh vegetation. April falls within razorback and bonytail spawning season, and within the Yuma clapper rail breeding season (LCR MSCP Appendix K.2.1). The largest reductions in river stage occur in April and, since the species life stages are more susceptible to changes in river stage during the spawning and breeding seasons, the greatest potential impacts to razorback sucker, bonytail and Yuma clapper rail would occur at this time . The 2004 LCR MSCP assumed a “worst case scenario” so impacts were based on the April modeling projections. This approach was continued during this analysis.

To evaluate the effects of the additional reduction in flow below Davis Dam, rating curves (i.e., stage-discharge relationships) were developed from flow and water surface elevations (LCR

MSCP Appendix J – Attachment D). These rating curves were then used to calculate the water surface elevations at various cross-section locations within Reach 3 for both the 860,000 afy and 1,574,000 afy reduction in flow amounts. The change in river stage was calculated from these results and used to estimate acres of affected back water, riverine and marsh habitat.

Table 1 shows the modeled decrease in river stage for both the 2004 reduction in flow analysis (0 to 860,000 afy) and the additional decrease in river stage due to the incremental reduction in flow under the proposed action (860,000 to 1,574,000 afy). The decrease in river stage in the 2004 LCR MSCP analysis ranged from a low of 0.55 feet to a high of 3.03 feet. The decrease in river stage due to the additional reduction in flow from the proposed action ranged from a low of 0.03 feet to a high of 0.6 feet.

Table 1.—Changes in River Stage During April from Reductions in River Flow

Reach	River Mile	Original Analysis Reduction in Stage (ft) 0 to 860,000 afy	Incremental Analysis Reduction in Stage (ft) 860,000 afy to 1,574,000 afy
3	270.5	-2.09	-0.03
3	267.2	-2.33	-0.03
3	262.9	-3.03	-0.04
3	255.1	-3.02	-0.04
3	259.6	-2.82	-0.04
3	248.9	-1.67	-0.55
3	243.9	-1.82	-0.60
3	240.8	-1.69	-0.56
3	237.6	-1.53	-0.50
3	234.7	-1.34	-0.49
3	229.8	-1.22	-0.41
3	225.0	-0.92	-0.30
3	220.2	-0.55	-0.17

The modeling analysis shows the incremental decrease in river stage resulting from the increased reduction in flow from 860,000 to 1,574,000 afy is very modest. This is because there are two Davis Dam operational factors that influence reduction in stage downstream: 1) a reduction in the magnitude of the low hourly flow based on Davis Dam operational criteria, and 2) a reduction in the total flow released from Davis Dam within a 24-hour period due to the increased reduction in flow. When flows are reduced by 860,000 afy, a reduction in the low hourly flow release occurs at Davis Dam. That causes Davis Dam to change operations from a two-unit hydropower generating flow release at baseline to a one-unit hydropower generating flow release. When the reduction in flow is increased from 860,000 to 1,574,000 afy, the low hourly flow stays at a one-unit hydropower flow release level; the reduction in hourly flows at the 1,574,000 afy do not reduce the capacity to produce hydropower enough to modify the one-unit release. Since the short-term, low hourly flow releases are the same for both the 860,000 afy and 1,574,000 afy reductions in flow, the reduction in river stage occurs over a longer time during the 24-hour period under the 1,574,000 afy scenario. A reduction in stage will occur, but it occurs further downstream as the flow attenuates through the entire reach.

ENVIRONMENTAL BASELINE

Habitat conditions in Reach 2 have not changed since the 2004 LCR MSCP analysis. Lake Mohave operations have remained consistent with the 1994 Memorandum and have not changed from the 2004 LCR MSCP environmental baseline. While flows have been reduced each year within Reach 2 under the 2007 Colorado River Interim Guidelines for Lower Basin Shortages and the Colorado River Drought Contingency Plan, water level fluctuations have been managed according to the 1994 Memorandum. The LCR MSCP has stocked 150,323 razorback suckers into Lake Mohave to protect and conserve the genetic diversity of the existing population with a goal of maintaining this population as a genetic refuge for the species (LCR MSCP HCP Section 5.7.6.2 RASU5, as amended by Program Decision Document 20-001). In 2020, the estimated population of adult razorback suckers in Lake Mohave was 5,100 individuals. In addition, 2,730 bonytail have been stocked as partial fulfillment to LCR MSCP HCP Conservation Measure BONY3 (LCR MSCP HCP Section 5.7.4.2). Due to the limited number of bonytail contacts, a population estimate could not be derived in 2020.

The LCR MSCP has established 18 conservation areas along the Colorado River and its' tributaries through agreements with landowners or agencies. Three conservation areas that are located within the Colorado River floodplain between Davis and Parker Dams (Reach 3) have had habitat established at this time. These include:

- The Beal Lake Conservation Area located adjacent to Topock Marsh, on the Havasu National Wildlife Refuge (NWR). Water needed for irrigation of established cottonwood-willow habitat, as well as Beal Lake itself, are supplied from Topock Marsh using the USFWS water entitlement for Havasu NWR. The LCR MSCP HCP requires the federal participants and non-federal permittees avoid impacts of flow-related covered actions and activities on covered species habitat at Topock Marsh (LCR MSCP HCP Section 5.6.1-AMM2). Reclamation entered into an agreement to provide funding to the USFWS to design and construct a new water delivery system for Topock Marsh to complete Avoidance and Minimization Measure 2 (AMM2) and received a letter from the USFWS on July 2, 2012, stating that no further action was required to meet the obligations of AMM2. Consequently, this proposed action does not impact Beal Lake Conservation Area.
- The Big Bend Conservation Area, located south of Laughlin, Nevada, on lands managed by the Nevada Division of State Lands. The Southern Nevada Water Authority (SNWA) acquired private upland property around an existing backwater to protect the backwater from development. This backwater was incorporated into the LCR MSCP as a conservation area and the SNWA received an in-kind credit towards their funding obligations for the LCR MSCP on October 22, 2008 (LCR MSCP Program Decision Document 09-002). The 15-acre backwater is connected to the mainstem Colorado River and fluctuates with water releases from Davis Dam, which is approximately 4 miles upstream. The LCR MSCP is responsible for managing the backwater habitat by removing sediment on a periodic basis. Reduced flow releases would not alter the management actions conducted by Reclamation to ensure the conservation area provides covered species habitat for backwater dependent species.
- Mojave Valley Conservation Area (MVCA), located within Park Moabi Regional Park, approximately 13 miles south of Needles, California. Reclamation entered into a lease with

the California State Lands Commission to create a 63-acre backwater that is directly connected to the Colorado River. Water control structures are used to maintain water elevations when river flows are low. Reduced flow releases would not impact MVCA.

Except for these LCR MSCP conservation areas, marsh, backwater, and riverine habitat has not changed since the 2004 LCR MSCP analysis.

The LCR MSCP has stocked 117,353 razorback suckers and 64,107 bonytail through FY2021 to augment extant populations within Reach 3. In 2020, the adult razorback sucker population was estimated at 5,422 individuals for this reach. A population estimate could not be calculated for bonytail due to limited contacts.

Effects of Hydrological Changes on Habitat Conditions

This section describes the potential effects of the additional reduction in flow on environmental conditions that provide habitat for covered species. Several assumptions were used in this analysis. Within the Colorado River floodplain, groundwater levels are directly correlated with the surface elevation of the Colorado River unless influenced by agricultural return flows. When Colorado River flows are reduced, groundwater elevations will also decrease, though timing of groundwater response is dependent on factors such as distance from the river and soil conditions. Since backwater and marsh are adjacent or in close proximity to the river, surface elevation reductions were used to estimate impacts to riverine, backwater, and marsh habitats from the proposed action. A bank slope angle was used to transform the effects of the vertical reduction in river stage to a horizontal area of land cover. For backwaters, a bank slope angle of 30 degrees was assumed because it is consistent with the past approach, which yielded conservative (high-end) estimates of impacted acres (2004 LCR MSCP Appendix K.2.2; Tables K1 and K2). The change in water surface elevation was combined with the 2000 backwater mapping used in the 2004 analysis to determine the amount of additional land cover type impacted. A review was done on a sample of the backwaters, which compared the 2000 calculated backwater acreage with current aerial imagery of the backwaters. This analysis showed that land cover acreage for backwater and marsh today is similar to the estimated acres mapped in 2000, as described in more detail below. Impacts from the increased reduction in flow could affect marsh, river, and backwater land cover.

Marsh: Emergent marsh provides habitat for the Yuma clapper rail and northern Mexican gartersnake. The 2004 LCR MSCP analysis noted that reduced river water surface elevations may cause a change in marsh plant composition, conversion of marsh land cover to woody riparian land cover types, an increase in plant density and extent resulting in the loss of open water, and a change in marsh function. An increase in the range of daily fluctuations in surface water elevations in marshes resulting from the proposed action could also affect the quality of habitat provided for some covered species (2004 LCR MSCP BA Section 5.2.3.3).

Using identical methods as the 2004 LCR MSCP analysis described above, Reclamation combined the estimated reduction in stage with the 2000 vegetation mapping data to estimate the effects of the increased reduction in flows from 860,000 afy to 1,574,000 afy on land cover types in Reach 3. The 2004 analysis estimated an impact to 24 acres of marsh in Reach 3. The results of the incremental analysis for this proposed action show that increasing the reduction in flow below Davis Dam to 1,574,000 afy could impact an additional 7 acres of marsh.

River Conditions: The 2004 LCR MSCP analysis noted that reduction in hourly river flows may affect the river's edge, riffles, and side channels. Depending on site-specific channel morphology, reduced depths in association with ongoing daily flow fluctuations could cause stranding of juvenile or adult razorback suckers and bonytail, and desiccation of fish eggs and aquatic organisms in or on the substrate (2004 LCR MSCP BA Section 5.2.3.5).

The results of this incremental analysis, described above, show that decreases in water surface elevation could be up to an additional 0.6 feet in certain locations in Reach 3. The change in surface water area in response to reduced depth indicates that the change in river surface area would be relatively small (an additional 6 acres, representing 0.2 percent of the total river surface area in Reach 3). The level of existing stranding and desiccation and how flow variability at a lower surface elevation interacts with channel morphology are currently unknown.

Backwater: Open water and emergent vegetation components of backwaters provide habitat for the Yuma clapper rail, northern Mexican gartersnake, bonytail, and razorback sucker. The 2004 LCR MSCP analysis noted that the change in river flow would affect backwater depth, surface area, flow continuity, and contaminant concentration. Reduced backwater depth, in combination with ongoing daily flow fluctuation, could increase stranding losses, displacement of small juveniles from nursery habitat and cover, and desiccation of aquatic organisms and fish eggs relative to the existing condition (2004 LCR MSCP BA Section 5.2.3.6).

The results of the incremental analysis, as described above, show that the change in backwater surface area in response to reduced depth would be small relative to total backwater area. An additional 9 acres would be impacted, which represents about 0.3 percent of the total surface area of backwaters in Reach 3. Reduced river flow may affect contaminant concentrations in connected backwaters. Effects depend on currently undocumented site-specific channel morphology and, given the relatively small proportion of backwater area affected, may be minor relative to productivity for all connected backwaters.

The increased reduction in flow would not impact any LCR MSCP established conservation areas as they are either located outside of the floodplain, have mechanisms in place to manage water surface elevations, or effects have been included in this analysis.

Effects on Threatened and Endangered Species

The proposed increase in reduction in flow below Davis Dam and implementation of conservation measures may impact marsh, river and backwater land cover types that are used by four threatened and endangered species. The proposed action could affect water levels in 15 acres of aquatic habitat (9 acres of backwater habitat plus 6 acres of riverine habitat) which is used by bonytail and razorback sucker. The proposed action could affect 7 acres of marsh habitat, which is used by Yuma clapper rail and northern Mexican gartersnake. Attachment 5 describes the effects to the species' habitat and is based on the effects analysis in Section 5.5 in the 2004 LCR MSCP BA.

Cumulative Effects

Cumulative effects are defined under ESA regulations as those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation. Section 6 of the 2004 LCR MSCP BA includes an analysis of cumulative effects from a range of future actions. Since these future actions have not changed, the prior analysis is adopted by reference, and there would not be any additional cumulative effects (2004 LCR MSCP BA Section 6).

Conservation Measures

Reclamation is proposing conservation measures for the four threatened and endangered species. These conservation measures are based on the species-specific conservation measures described in Section 5.7 of the 2004 LCR MSCP HCP and were derived using the same methodology. During the 2004 LCR MSCP consultation, the USFWS established mitigation ratios for each land cover type affected by the proposed actions and activities. The marsh mitigation ratio was to create and manage or protect approximately 2 new acres for every marsh acre affected, while the backwater ratio was to create and manage or protect 1 new acre of backwater habitat for every 1 acre of backwater or riverine habitat affected by the 2004 covered actions and activities. These ratios were used to propose conservation measures for this proposed action. To offset potential impacts to 7 acres of marsh habitat, an additional 15 acres of marsh would be created and managed or protected to benefit the Yuma clapper rail and northern Mexican gartersnake. To offset the possible impacts to 15 acres of aquatic habitat (9 acres of backwater and 6 acres of riverine habitat), an additional 15 acres of backwater would be created and managed or protected to benefit the bonytail and razorback sucker in Reach 3. It is not possible to create riverine habitat so the additional backwater acres will offset impacts to aquatic habitat. Attachment 6 describes proposed habitat creation conservation measures for the four species: CLRA1-1, BONY2-1, RASU3-1, and NMGS1-1. Existing 2004 LCR MSCP HCP avoidance and minimization measures, monitoring and research measures, and conservation area management measures will also continue to offset effects to the four threatened and endangered species from the increased reduction in flow.

Assessment of Conservation Measure Implementation Effects

The additional conservation measures are intended to be beneficial to the covered species. However, implementation of some conservation measures to create covered species' habitat may have short-term adverse effects during construction or prior to development of species habitat. The primary impact mechanisms include physical disturbance, biological disturbance, and irrigation drainage associated with establishing and managing created covered species habitats. Since specific locations where the conservation measures would be implemented were not identified, the assessment of impacts in the 2004 LCR MSCP analysis was qualitative and based on the types of effects that such activities would likely have on covered species if the activities were implemented in their habitat (2004 LCR MSCP BA Section 5.4.2). Implementation of the additional conservation measures are expected to result in the same types of effects.

Summary of Effects

Attachment 7 summarizes the potential effects of implementing the increased reduction in flow and conservation measures.

Implementation Schedule

The 2004 LCR MSCP HCP anticipated that the establishment of required land cover would be completed by program year 30 (FY35). The additional 15 acres of marsh land cover and 15 acres of backwater land cover will be completed consistent with those provisions (2004 LCR MSCP HCP Section 5.10). The 2004 LCR MSCP HCP estimated that 4,154 acres of land cover would be established during the first 16 years of program implementation (2004 LCR MSCP HCP Section 5.10). At the end of Fiscal Year 2021, approximately 6,950 acres out of the 8,132 acres of required land cover, have already been established. Since Reclamation is accomplishing these habitat creation conservation measures at a faster rate than anticipated, we believe we can accomplish these proposed conservation measures within the 2004 schedule.

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Attachment 1

Status of Four Threatened and Endangered Species in Reaches 2 and 3, including Critical Habitat

Yuma Clapper Rail

Reach 3

Most Yuma clapper rails found in Reach 3 are in Topock Marsh and Topock Gorge, with small populations in the marshes of the Bill Williams River Delta and Beal Lake. Table 1-7 shows the Yuma clapper rail detections in Topock George, Beal Lake, Topock Marsh and the Bill Williams River Delta since implementation of the LCR MSCP.

Table 1-7.—Yuma clapper rail detections

	Topock Gorge[1]			Beal Lake[2]			Topock Marsh[3]			Bill William Delta[4]		
Fiscal Year	March	April	May	March	April	May	March	April	May	March	April	May
2006	20	19	30	NS[5]	NS	NS	NS	10	12	NS	2	14
2007	17	61	20	NS	NS	NS	NS	7	15	7	NS	7
2008	35	47	58	NS	NS	NS	NS	13	18	2	NS	6
2009	54	35	57	NS	NS	NS	NS	27	17	NS	13	2
2010	36	46	59	NS	NS	NS	NS	22	18	NS	17	1
2011	38	76	70	NS	NS	NS	NS	14	30	15	9	12
2012	23	54	53	0	1	2	9	25	23	10	11	8
2013	50	38	62	0	0	NS	9	19	16	8	5	10
2014	24	82	66	0	1	4	24	26	35	4	NS	NS
2015	85	12	109	1	1	0	48	32	31	UD[6]	3	4
2016	37	70	65	0	5	3	17	41	48	6	1	7
2017	55	81	76	2	2	NS	17	18	30	6	16	10
2018	19	52	54	0	4	9	NS	NS	NS	NS	NS	NS
2019	63	51	47	11	11	13	31	44	45	9	11	2
2020	NS	NS	NS	NS	NS	NS	5	NS	NS	8	NS	NS
2021	15	26	51	NS	NS	NS	17	35	33	0	2	9

[1]Topock Gorge per survey period (Kahl 2008, 2009, 2010a, 2010b, 2012a, 2012b, 2013b, 2015a, 2016, 2018b, 2018b, 2019b, and 2021b)
[2]Beal Lake per survey period (Kahl 2013a, 2015b, Kahl 2018a, and 2019a; Ronning and Kahl 2017a and 2017b;).
[3]Topock Marsh per survey period. An accumulation of results from 4 to 8 survey routes within the marsh including: Goose Lake, Lower Marsh, North Dike, South Dike 1, South Dike 2, Whiskey Slough, Glory Hole1 and Glory Hole2 (unpublished data from FWS in the Avian Knowledge Network).
[4]Bill Williams River Delta route (unpublished data from FWS in the Avian Knowledge Network).
[5]Not Surveyed.
[6]Unable to get data.

Critical Habitat

No critical habitat has been designated for the Yuma clapper rail.

Bonytail

Reach 2

As of fiscal year 2021, the LCR MSCP has released 2,730 bonytail into Reach 2 (Final Implementation Report, Fiscal Year 2023 Work Plan and Budget, and Fiscal Year 2021 Accomplishment Report, *in draft*). These releases were initiated in fiscal year 2016 to gather information on post-stocking distribution, habitat selection, habitat use, and survival, with the goal of using this information to (1) indicate locations that may be better suited for stocking native fishes, (2) assist in developing a more robust monitoring network in terms of where to locate remote sensing equipment or other sampling gear to increase contact probabilities, and (3) to identify locations where native fishes aggregate. Research and monitoring efforts have returned only short-term recontact data, and few individuals have been contacted greater than 12 months post release. Due to the limited number of long-term recontacts, no population estimate is available for this reach.

Bonytail spawning habitat has generally been described as relatively shallow, near-shore areas with loose substrates of various sizes. In Reach 2, bonytail were historically observed spawning over gravel, cobble, and rocky substrates at depths of 1.5–3.5 meters (Jonez and Sumner 1954). Bonytail have rarely been contacted following stockings in the LCR, and no observations of physical spawning condition or activity have been documented in Reach 2. There are currently no know spawning locations for bonytail in the LCR.

Reach 3

As of fiscal year 2021, the LCR MSCP has released over 64,000 bonytail into Reach 3 (Final Implementation Report, Fiscal Year 2023 Work Plan and Budget, and Fiscal Year 2021 Accomplishment Report, *in draft*). Research and monitoring efforts have generally returned only short-term recontact data, typically within the first several months following release, and few individuals have been contacted greater than 12 months post release. Due to the limited number of long-term recontacts, no population estimate is available for this reach.

Spawning habitat has generally been described as relatively shallow, near-shore areas with loose substrates of various sizes. In lentic environments (e.g., reservoirs, backwaters, ponds, etc.), bonytail have been observed spawning over gravel, cobble, and rocky substrates at depths of 1.5–3.5 meters (Jonez and Sumner 1954; Mueller 2006). It is hypothesized that they spawn over similar substrates in lotic (flowing) environments, but no direct observations of bonytail spawning in riverine habitat have been reported. Bonytail have rarely been contacted following stockings in the LCR, and no observations of physical spawning condition or activity have been documented in Reach 3. There are currently no known spawning locations for bonytail in the LCR.

Critical Habitat

Critical habitat was designated for the bonytail in 1994 and encompasses the Colorado River from Hoover Dam to Davis Dam (Reach 2) and from the northern boundary of Havasu NWR to

Parker Dam (Reach 3). Principle constituent elements of critical habitat include: (1) water; (2) physical habitat; and (3) biological environment for each life stage (Federal Register Vol.59, No.54, 1994)

Razorback Sucker

Reach 2

Monitoring of the razorback sucker population in Reach 2 has occurred on an annual basis for over 30 years. Studies conducted in the early 1990s suggested that this was the largest known population of wild razorback suckers within the species' range, with annual abundance estimates exceeding 40,000 individuals (Marsh et al. 2003). The wild population in Reach 2 experienced considerable decline since the mid-1990s (Dowling et al. 2014); however, a population of genetically diverse adult fish has been maintained through ongoing augmentation efforts.

Prior to 2005, approximately 98,000 razorback suckers were released into Reach 2 to conserve the extant population and its genetic diversity. As of September 2021, the LCR MSCP has released over 150,000 additional razorback suckers to augment this population (Final Implementation Report, Fiscal Year 2023 Work Plan and Budget, and Fiscal Year 2021 Accomplishment Report, *in draft*). Remote passive integrated transponder [PIT] scanning has been used since 2011 to successfully contact razorback suckers throughout Reach 2 (table 1-1). These monitoring efforts have greatly increased contact and recontact rates for native fishes, allowing for more accurate population estimates to be generated on an annual basis. Population estimates for the 2016–20 monitoring years are presented in table 1-2.

Table 1-1.—Razorback suckers contacted via remote PIT scanning; LCR MSCP Reach 2, 2016–20

Year	Number of Unique Razorback Suckers
2016	3,128
2017	3,490
2018	3,471
2019	4,408
2020	5,844

Table 1-2.—Razorback Sucker Population Estimates; LCR MSCP Reach 2, 2016–20

Year	Population Estimate	95% CI
2015-16	3,656	3,418–3,912
2016-17	3,815	3,573–4,073
2017-18	3,471	3,365–3,576
2018-19	3,649	3,552–3,745
2019-20	3,906	3,789–4,002

Spawning habitat for razorback suckers is characterized by relatively shallow, flat to gently sloping shoreline areas with clean gravel, cobble, or mixed substrates (Bestgen 1990; Mueller and Marsh 1998; Kegerries et al. 2009; Kesner et al. 2012; Albrecht et al. 2013). Spawning typically occurs in 0.5–2 meters of water, but it has also been reported at depths of 10–20 meters in LCR reservoirs (Minckley et al. 1991; Holden et al. 1997, 1999; Valdez et al .2012). Four known spawning locations (i.e., areas attracting spawning groups of > 100 razorback suckers) are currently monitored in Reach 2 on an annual basis (table 1-3).

Table 1-3.—Razorback Sucker Spawning Locations; LCR MSCP River Reach 2

Name	UTM (E)	UTM (N)	Latitude	Longitude	River Mile
Black Bar	706780	3977568	35.920593	-114.708181	334
Yuma Cove	712669	3933587	35.523115	-114.654613	300
Tequila Cove	710610	3928238	35.475360	-114.678687	297
Halfway Wash	710652	3922776	35.426146	-114.679641	293

Reach 3

Razorback suckers have been documented in both backwater and riverine habitat extending upstream from Lake Havasu to Davis Dam (RM 217–276). Documented captures and contacts have occurred at approximately 20 backwater and 50 riverine locations since remote PIT scanning was adopted as the primary method of monitoring. Current data suggest that habitat use is similar across seasons; however, large aggregations of razorback suckers have been documented in both habitats during the spawning season (January – April). Since 2014, over 7,000 unique razorback suckers have been captured or contacted at known and suspected spawning locations in Reach 3.

Razorback suckers were stocked into Reach 3 in the early 1990s. Studies conducted in the early 2000s suggested that a portion of these fish integrated with wild individuals and established a spawning population in the riverine portion of the reach approximately 0.5–1.5 miles upstream of Needles, California. Traditional sampling methods had limited success in capturing large numbers of razorback suckers during the study period (< 60 fish were captured each year from 2003–05), resulting in low-precision population estimates for those years. Wydoski and Mueller (2006) reported these estimates as 3,750 individuals (95% confidence interval [CI]: 1,306–8,925) in 2003, 1,768 individuals (95% CI: 878–3,867) in 2004, and 1,652 individuals (95% CI: 706–5,164) in 2005.

As of September 2021, the LCR MSCP has released over 118,000 razorback suckers to augment the Reach 3 population (Final Implementation Report, Fiscal Year 2023 Work Plan and Budget, and Fiscal Year 2021 Accomplishment Report, *in draft*). Remote PIT scanning has been used to monitor this population since 2011, and during the last 5 years (2016–20), it has been used in conjunction with traditional sampling methods to successfully contact large numbers of razorback suckers throughout the upper portion of the reach (river miles 217–276; table 1-4). These monitoring efforts have greatly increased contact and recontact rates for native fishes, allowing for more accurate population estimates to be generated on an annual basis. Population estimates for the 2016–20 monitoring years are presented in table 1-5.

Table 1-4.—Razorback suckers captured or contacted in LCR MSCP Reach 3, 2016–20

Year	Number of Unique Razorback Suckers
2016	3,027
2017	3,306
2018	3,371
2019	5,552
2020	8,674

Table 1-5.—Razorback Sucker Population Estimates, LCR MSCP Reach 3, 2016–20

Year	Population Estimate	95% CI
2016	4,923	4,652–5,209
2017	5,337	5,043–5,633
2018	3,803	3,616–4,024
2019	4,791	4.328–5,254
2020	4,864	4,633–5,095

Razorback sucker spawning in Reach 3 has generally been observed at depths of less than two meters. Razorback suckers are confirmed or suspected of spawning in the river and its associated backwaters from Laughlin, Nevada downstream to Topock Gorge. Six known spawning locations (i.e., areas attracting spawning groups of ≥ 100 razorback suckers) are currently monitored on an annual basis (table 1-6).

Table 1-6.—Razorback Sucker Spawning Locations, LCR MSCP River Reach 3

Name	General Location	UTM (E)	UTM (N)	Latitude	Longitude	River Mile
Razorback Island	Laughlin	714631	3887040	35.103336	-114.645183	267
Cliffs	Needles (North)	716245	3861468	34.872594	-114.634131	248
White Wall	Needles	716656	3860628	34.864939	-114.629855	247
Power Lines	Needles	717290	3860020	34.859325	-114.623082	247
Airport Wash	Needles (South)	722026	3853531	34.799839	-114.573033	242
Manzanita Wash	Needles (South)	722207	3852868	34.793826	-114.571231	241

Critical Habitat

Critical habitat was designated for the razorback sucker in 1994, including the Colorado River from Hoover Dam to Davis Dam (Reach 2). Principle constituent elements of critical habitat include: (1) water; (2) physical habitat; and (3) biological environment for each life stage (Federal Register Vol.59, No.54, 1994)

Northern Mexican Gartersnake

Reach 3

In 2015, a northern Mexican gartersnake was confirmed at the LCR MSCP's Beal Lake Conservation Area in the riparian field next to Willow Marsh on Havasu National Wildlife Refuge near Needles, California in LCR Reach 3. Subsequently in 2019, FWS conducted a study at six sites in Havasu National Wildlife Refuge within Topock Marsh and Beal Lake Conservation Area and detected 15 individual northern Mexican gartersnakes, 7 at Beal Lake Conservation Area in Willow Marsh, and 8 at the Glory Hole site on Topock Marsh (Bourne and Hammer 2020).

Critical Habitat

Critical habitat was designated for the northern Mexican gartersnake in 2021. The LCR MSCP planning area was excluded from this critical habitat designation.

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Attachment 2

Updated Species Accounts of Four Threatened and Endangered Species

LCR MSCP Appendix I

I.1.1.1 Yuma Clapper Rail (Rallus longirostris yumanensis)

Legal Status

The Yuma clapper rail is listed as endangered under the Federal Endangered Species Act (ESA) and threatened under the California Endangered Species Act (CESA).

Other Status

The Yuma clapper rail is also:

- a G5T3 (global rank),
- N3 (national rank),
- S3 (state rank) in Arizona,
- S1S2 (state rank) in California, and
- S1 (state rank) in Nevada.

Species Distribution

In 2005, the Yuma clapper rail occurring primarily along the lower Colorado River (LCR) in California, Arizona, and Sonora Mexico, was considered one of seven North American subspecies of clapper rails. In 2014, the American Ornithological Society recognized a change in the species name from Yuma clapper rail (*Rallus longirostris yumanensis*) to the Yuma Ridgway's rail (*Rallus obsoletus yumanensis*) (Chesser et al. 2014 and Maley and Brumfield 2013). The previous clapper rail (*Rallus longirostris)* was split into three species. The western three resident subspecies of *Rallus longirostris* became subspecies of *Rallus obsoletus*: *yumanensis* (in the lower Colorado River area), *levipes* (in coastal southern California), and *obsoletus*, (in coastal marshes of the San Francisco Bay area).

The Yuma clapper rail has a range that extends from Nevada, California, and Arizona to Baja California and Sonora Mexico. They are regularly detected during breeding season along the LCR from Topock Marsh south to Yuma in the United States and at the Colorado River Delta in Mexico. Some individuals are resident year-round, while others migrate between the Lower Colorado River and coastal estuaries along the Gulf of California in Sonora, Mexico (Harrity and Conway 2018 and 2020). There are also populations of this subspecies at the Salton Sea in California (Garrett and Dunn 1981); Ash Meadow National Wildlife Refuge, Overton Wildlife Management Area (Harrity and Conway 2020), Las Vegas Wash and Key Pittman Wildlife Management Areas in Nevada (USFWS unpublished data); and along the Gila and Salt Rivers to Picacho Reservoir and Blue Point in central Arizona (Rosenberg et al. 1991). Clapper rails also been detected less frequently and in small numbers at Laughlin, and the Virgin River in southern Nevada (Nevada Department of Wildlife 1998; McKernan and Braden 2002).

Habitat Requirements and Special Considerations

The Yuma clapper rail generally lives in freshwater and brackish marshes dominated by cattail (*Typha* sp.) and bulrush (*Scirpus* sp.) with a mix of riparian tree and shrub species [willows (*Salix exigua* and *S. gooddingii),* saltcedar (*Tamarix* sp.), arrowweed (*Pluchea serica*), and *Baccharis* sp.] along the shoreline of the marsh (Gould 1975, Smith 1975, Anderson and Ohmart 1985, Todd 1986, Eddleman 1989, USFWS 2010). Along the LCR, such habitats are generally found in backwaters or in the impoundments behind dams (USFWS 2010). At the Salton Sea, marsh habitats are created in fields or cells with managed water levels (USFWS 2010). Along the lower Gila, Virgin, and Muddy Rivers, marshes are found along the margins of the river and wetted floodplain (USFWS 2010). At the Cienega de Santa Clara in Mexico, the marsh is large and dense with vegetated areas interspersed with shallow open water areas (Hinojosa-Huerta et al. 2000). In other areas of Mexico, the subspecies is associated with brackish marshes dominated by dense stands of saltcedar with an understory of iodine bush, and coastal estuaries, some containing mangroves and others containing dense glasswort (*Salicornia* spp.) mats, and saltgrass (*Distichlis* sp.) and panicgrass (*Dichanthelium* sp.) (Harrity and Conway 2018).

The estimated amount of Yuma clapper rail habitat totals 10,551 acres in the U.S. and 18,532 acres in Mexico (USFWS 2010). The literature suggests that optimal breeding habitat contains a mosaic of: emergent vegetation averaging greater than 6 ft high (Anderson and Ohmart 1985, Eddleman 1989); shallow (less than 12 in) open water areas either as channels or pools with either minimal daily water fluctuation (Tomlinson and Todd 1973, Gould 1975) or areas available that remain shallow as water levels fluctuate (Dodge and Rudd 2017); open dry ground (slightly higher than the water level) between water, vegetation, or marsh edge for foraging and movement (Gould 1975, Anderson and Ohmart 1985, Eddleman 1989, Conway et al. 1993). Home ranges are generally smallest during the early and late breeding seasons (March through July) at 17- 20 acres and largest in the post breeding period (August through October) at 37 acres and late winter period (January through February) at 59 acres (Conway et al. 1993). Both sexes have similar home range sizes except in the post breeding season, when females averaged about 51 acres and males 22 acres (Eddleman 1989). Home ranges were found to overlap extensively. Eddleman (1989) found great seasonal variations in home ranges (for males, the largest was 24.0 ha □ 15.7 SD, n = 6 in January and February and the smallest was 3.6 ha □ 2.8 SD, n = 9 during incubations) (for females, the largest was 21.0 ha □ 8.7 SD, n = 8 and the smallest was 2.2 ha □ 18 SD, n = 4 during incubation). The wide range of home range and activity area sizes indicates that Yuma clapper rails can successfully inhabit a range of marsh sizes; however, the mosaic of habitat features must be met within the area (USFWS 2010).

The Yuma clapper rail begins nesting activities by February. Young hatch in the first week of June and suffer high mortality from predators in their first month of life (Rosenberg et al. 1991). Crayfish are a primary food source of this subspecies along the LCR and may be a limiting factor restricting rail occurrence (Ohmart and Tomlinson 1977; Eddleman 1989). Other food items include small fish, isopods, insects, spiders, freshwater shrimp, clams, and seeds (California Department of Fish and Game 1991; Rosenberg et al. 1991; Eddleman and Conway 1998).

Rosenberg et al. (1991) list several unique qualities of the Yuma clapper rail that may be pertinent to conservation planning efforts. For example, relative to other subspecies, the Yuma clapper rail has an ability to colonize new habitats because of its partly migratory behavior and the prompt dispersal of juveniles following breeding. In addition, it effectively uses food resources characteristic of freshwater marshes.

Regionally Significant Populations in the LCR MSCP Planning Area

Populations of Yuma clapper rails are found within the Lower Colorado River Multi-Species Conservation Program (LCR MSCP) planning area in Reaches 3–6. An analysis of survey data from 1995 to 2013 showed that between 30 and 58% of the Yuma clapper rails detected in the United States were within the LCR MSCP planning area (USFWS 2005; USFWS 2013).

- Most Yuma clapper rails located in Reach 3 were in Topock Marsh and Topock Gorge, and a small population was in the marshes of the Bill Williams River Delta.
- In Reach 4, the Cibola National Wildlife Refuge provides habitat for almost all Yuma clapper rails detected during surveys.
- In Reach 5, rails were detected in the Imperial National Wildlife Refuge, Picacho State Recreation Area, and between Martinez Lake and Imperial Dam.
- In Reach 6, most rails were located between Imperial Dam and Laguna Dam, including Mittry Lake and Laguna Division Conservation Area. They have also been detected at Yuma East Wetlands.

On average, the percentage of Yuma clapper rails detected within the LCR MSCP planning area were: Reach 3: 31.6%, Reach 4: 16.8%; Reach 5: 25.3%; Reach 6: 25.7%; and Reach 7: 0.6% (LCR MSCP 2016).

Population Status, Reasons for Decline

The survey results for the Yuma clapper rail in the U.S. only provide a minimum number of rails present. Over the 2000-2008 period, the numbers fluctuated between 503 and 890 (USFWS 2010), reaching the minimum recovery population size of over 700 (USFWS 1983) in 5 of those 9 years. Actual numbers of rails heard during surveys at the Cienega de Santa Clara and other sites in Mexico from 1998 through 2006 ranged from 164 to 382. The 2006 population estimate for the Cienega was 5,974 (Hinojosa-Huerta et al. 2008). Range-wide surveys detected fewer than 1000 individuals in the U.S. each year from 2014 to 2019 (U.S. Fish and Wildlife Service, unpublished data cited in Harrity and Conway 2020).

The species is currently considered to have a high degree of threat and low recovery potential from loss of habitat due to lack of natural river processes that create and maintain marshes, and lack of security relative to the protection of existing habitats in the U.S. and Mexico (USFWS 2010). Historically, cattail/bulrush marshes in the Colorado River Delta were likely the stronghold for the species. The elimination of freshwater flows down the LCR to the Delta due to diversions from the river resulted in loss of that habitat. The current habitats are primarily formed behind dams and diversions on the LCR and human-made marshes and ponds including Beal Lake, Hart Mine Marsh, Imperial Ponds, the ponds at Salton Sea and the marshes at the

Cienega de Santa Clara. The existing habitat is subject to natural successional processes that reduce habitat value over time without also being subject to natural restorative events generated by a natural hydrograph (USFWS 2010).

Current Threats to Species Survival

The Yuma clapper rail is threatened by river management activities that are detrimental to marsh formation, such as dredging, channelization, bank stabilization, and other flood control measures. Another serious threat is environmental contamination caused by selenium. High selenium levels have been documented in some adult birds and eggs and in crayfish populations. Selenium, which may cause metabolic problems and affect the reproductive success of clapper rails, appears to be coming from upstream coal-fired plants, mining, natural weathering, and agricultural runoff (Rosenberg et al. 1991). Selenium is known to accumulate in backwater marshes (Martinez 1994; Rusk 1991). Based on analyses of selenium in tissue samples from marsh birds and invertebrates, Rusk (1991) concluded that the risk for mortality of adult birds from selenium is low and assessed the risk for the development of genetic deformities in marsh birds that use backwaters as moderate to high. Other threats to the Yuma clapper rail include fires during their breeding season (Todd 1986), mosquito abatement activities, agricultural activities, development, and the displacement of native plant communities by exotic vegetation (California Department of Fish and Game 1991).

The large population of Yuma clapper rails at the Cienega de Santa Clara is threatened by the loss of the source of water that maintains the wetlands. The Cienega de Santa Clara population is supported by the Wellton-Mohawk Main Outlet Drain Extension (MODE) and Riito drain waters (Glenn et al. 1996). Since 1977, the MODE has carried 4.2–6.4 $x10^9$ cubic feet per year of mildly saline (i.e., 3 parts per thousand) groundwater from the Wellton-Mohawk Irrigation District in Arizona for disposal in the eastern delta (Burnett et al. 1993). Future water management decisions may result in the diversion of the MODE drain waters away from the Cienega de Santa Clara. Diversion of the MODE water would likely result in the elimination of dominant wetland vegetation and functions at the Cienega de Santa Clara (Burnett et al. 1993; Glenn et al. 1995, 1996; Zengel et al. 1995). A large-scale conversion of wetlands would have drastic impacts on the Yuma clapper rail population that inhabits the Cienega de Santa Clara.

Existing Management Actions

Bureau of Reclamation (1998a) is ensuring that its operations and maintenance actions will result in no net loss of Yuma clapper rail habitat in accordance with the LCR MSCP HCP. Toward this end, Reclamation prepared a Yuma clapper rail management plan for areas under its management (Bureau of Reclamation 1998b,) and is creating and managing 512 acres of marsh habitat for the species, while providing funding to protect and enhance existing habitat along the LCR. Reclamation also ensured that all ground disturbing activities (e.g., channel maintenance activities) avoid rail habitat and are not conducted near rail habitat during the nesting season.

Arizona Partners in Flight (Latta et al. 1999) has designated the Yuma clapper rail as a priority species for marsh areas. In addition, a wide variety of habitat-based management actions are ongoing throughout the LCR Basin. Most of these actions are small-scale projects that focus on the restoration/enhancement of native riparian, riverine, and marsh areas. Cumulatively, these actions have the potential to aid significantly in efforts to conserve the Yuma clapper rail.

Management Needs

The Yuma clapper rail recovery plan (U.S. Fish and Wildlife Service 1983) identifies several management activities necessary to reach recovery goals. These activities include:

- regional sampling at 5-year intervals in known, occupied areas and localized sampling on an annual basis;
- studies to determine behavior and biological requirements of the species;
- preservation and maintenance of breeding habitat in the United States;
- identification, protection, and management of wintering habitat in the United States and Mexico;
- public education programs; and
- a data-sharing program with local ornithological societies.

Recovery Goals

The USFWS approved the Yuma clapper rail recovery plan in 1983. A draft revision was submitted for public comment in 2010, but it has not yet been finalized. The stated purpose of the recovery plan is to provide natural resource management agencies and conservation groups with background information on the Yuma clapper rail and indicate new or ongoing tasks needed to achieve eventual Federal and state delisting of the species (U.S. Fish and Wildlife Service 1983).

Primary Objective: To assure the continued survival of a total breeding population of 700-1,000 Yuma clapper rails in the United States. Consideration for delisting the Yuma clapper rail will be based on an assessment of the U.S. and Mexican populations.

1. To maintain a minimum population of 700-1,000 breeding Yuma clapper rails in the United States.
    - 1.1 To sample every five years all known regions where Yuma clapper rail populations are found using standardized techniques and to develop and implement a plan of local population surveys every year.
        - 1.1.1 Conduct local (U.S.) population surveys every year.
        - 1.1.2 Conduct survey of breeding rails in Mexico.
    - 1.2 To determine biological requirements and behavior of the Yuma clapper rail.
        - 1.2.1 Investigate behavior parameters during breeding and nesting.
        - 1.2.2 Determine life history patterns with emphasis on life span and mortality.
        - 1.2.3 Summarize breeding and nesting habitat parameters that support various densities of Yuma clapper rails.
    - 1.3 To preserve and maintain breeding habitat to support the populations of Yuma clapper rails in the United States.

1.3.1 To survey the amount of breeding habitat available to the Yuma clapper rail once every 5 years.
1.3.2 To continue to preserve, protect, and manage rail habitat on State and Federal lands.
1.3.2.1 Havasu National Wildlife Refuge
1.3.2.2 Cibola National Wildlife Refuge
1.3.2.3 Imperial National Wildlife Refuge
1.3.2.4 Salton Sea National Wildlife Refuge
1.3.2.5 Yuma District, Bureau of Land Management
1.3.2.6 Mittry Lake (Arizona)
1.3.2.7 Imperial Wildlife Management Area (California)
1.3.2.8 Disjunct populations
1.3.3 To assure that dams along the lower Colorado River maintain a constant flow of water at a rate sufficient for the maintenance of Yuma clapper rail breeding habitat.
1.3.3.1 Summarize flow information over the past 10 years.
1.3.3.2 Establish an agreement to maintain the required flow.
1.3.4 Determine if other areas exist that could be developed to provide Yuma clapper rail habitat.

2. To preserve winter habitat of the Yuma clapper rail so that population survival is assured.
2.1 To determine, protect and manage winter habitat of the Yuma clapper rail in the United States.
2.1.1 To determine movement patterns of the Yuma clapper rail.
2.1.2 To preserve winter habitat.
2.2 To locate, manage, and protect winter habitat of the Yuma clapper rail in Mexico.
2.2.1 Determine the extent of winter habitat in Mexico and habitat features required for survival of the rails.
2.2.2 To establish a United States/Mexican agreement for preservation and management of Yuma clapper rail habitat.
2.2.3 To manage winter habitat of the Yuma clapper rail in Mexico.

3. To carry out a program of public conservation education and planning advice directed towards preservation of rail habitat.
3.1 To prepare public information bulletins for private landowners which address management of land for Yuma clapper rail, size of tracts that support breeding rails and the impact of nearby development on the birds.
3.2 To assist local ornithological societies by making data available on the rail population status and habitat.

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I.1.1.4 Bonytail (*Gila elegans)*

Legal Status

Bonytail is listed as endangered under the ESA and CESA and is Nevada State Endangered. Critical habitat has been designated for bonytail within the Lower Colorado River Multi-Species Conservation Program (LCR MSCP) planning area and includes the river between Hoover Dam and Davis Dam, including Lake Mohave to its full-pool elevation, and the northern boundary of the Havasu NWR to Parker Dam, including Lake Havasu.

Other Status

Bonytail is also:

- a G1 (global rank) and an S1 (state rank) in the Arizona Natural Heritage Program Database,
- a wildlife species of concern in Arizona,
- a G1 (global rank) and an S1 (state rank) in the CNDDB, and
- a G1 (global rank) and an S1 (state rank) in the Nevada Natural Heritage Program.

Species Distribution and Regionally Significant Populations in the LCR MSCP Planning Area

The bonytail is similar in appearance to other members of the *Gila* complex that occur in the Colorado River Basin. Positive identification in the field is difficult, and some information regarding historical distribution may be inaccurate (U.S. Fish and Wildlife Service [USFWS] 1997). Historically, the bonytail is thought to have occurred in most of the Colorado River Basin from Wyoming to the Gulf of California. Included in this historical range are the mainstem Colorado River, Upper Basin tributaries (i.e., Yampa, Gunnison, San Juan, and Green Rivers), and Lower Basin tributaries (i.e., Salt, Gila, and Verde Rivers). Only 40 bonytail have been captured in the Upper Basin since 1975, and most were captured from the Green River in Utah and the Yampa River in Colorado (Tyus and Karp 1989).

The bonytail has been extirpated from the LCR and its tributaries. Wild adult assemblages in the LCR MSCP planning area were previously found in Lake Mohave (Reach 2), and there were reports that a few wild adults may have also persisted in Lake Havasu (Reach 3). The adult assemblages that survived did so due to their longevity; adults are known to reach 49 years of age (Minckley 1985). During the period between 1976 and 1988, 34 bonytail were captured from Lake Mohave. Some of these fish were incorporated into the establishment of a captive broodstock – the progeny of which are presently stocked into the LCR (Minckley et al. 1989, Johnson and Jensen 1991; USFWS 2002) and several Upper Basin rivers. Bonytail abundance in Lake Mohave was consistently low in the early 1980s (Bozek et al. 1984) because of the mortality of older fish; however, wild adults and younger bonytail of adult size were still found in Lake Mohave in the 1990s (USFWS 2002). Persistence of bonytail in the LCR currently relies on continued augmentation efforts (Marsh et. al 2013; Pacey and Marsh 2008). As of 2003, the USFWS had stocked 31,000 bonytail into Lake Mohave and the Lake Havasu Fisheries Improvement Program had stocked 23,000 bonytail into Lake Havasu. Both impoundments are currently being augmented with fish reared in hatcheries or other predator-free environments, and as of federal fiscal year 2021, the LCR MSCP has stocked 125,971 bonytail into the LCR below Hoover Dam. Due to the limited number of long-term recontacts, no population estimate is available for this reach.

Habitat Requirements and Special Considerations

Very little is known about the bonytail life history and habitat requirements because of the scarcity of this species in natural environments. Pacey and Marsh (1998) report that adult bonytail in rivers prefer habitats that are similar to those used by humpback chub. However, the assumption does not seem appropriate. Humpback chub do not appear to have been common in the LCR system and likely have somewhat more restrictive habitat requirements than bonytail. Bonytail, prior to major introductions of nonnative species and closure of Hoover Dam, was historically the most abundant fish species in the main river channels of the entire Colorado River system. Preferred habitats for bonytail include "modest mid-channel currents of sandy, valley, and flat water reaches (Pacey and Marsh 1998)." Vanicek (1967) found that bonytail adults in Upper Basin riverine environments occupy pools and eddies away from strong currents. Bonytail were probably found in river channel types where water was 3–4 feet deep, had moderate and relative constant water current velocities, and had a substrate composed mainly of gravel, sand, and silt.

In the Lower Basin, bonytail populations are limited to artificial impoundments, including ponds and reservoirs. In reservoirs, bonytail are mostly pelagic, except during spawning events when they move to shallow rocky areas (Pacey and Marsh 1998). Within reservoirs, bonytail reputedly occur in lacustrine environments rather than riverine environments. Telemetry studies in Cibola High Levee Pond revealed that adult bonytail prefer interstitial spaces associated with shoreline riprap during daylight hours, whereas open-water areas are more commonly used during nighttime hours (Mueller 2006; Marsh et al. 2013). Intensive telemetric surveillance suggests a high degree of site-specific habitat fidelity, with individually marked bonytail consistently returning each morning to the same zone, often to the exact cavity formed within the riprap-type shoreline (Marsh et al. 2013). These areas may simulate the boulder fields of many of the Upper Basin canyon areas where bonytail were once common.

Bonytail have been documented to spawn over gravel substrates near shore and were found in water up to 30 feet deep in reservoir situations (Jonez and Sumner 1954). Documentation of successful, natural reproduction in Cibola High Levee Pond also suggests that the species selects shoreline-associated, small cobble substrate in water less than 1.0 meter deep for spawning activities (Mueller et al. 2005). Bonytail spawning has never been observed in a riverine environment, but collections of ripe fish from Dinosaur National Monument indicate spawning occurred during late June and early July in the Upper Basin. Mueller (2006) reported spawning in March and April in Cibola High Levee Pond, in early May in Lake Mohave, and as late as early June in the upper Green River; the commonality of these dates appears to be water temperatures ranging from 18–20 degrees Celsius (°C).

Under controlled conditions in hatcheries, optimum temperatures for reproduction range from 20 to 21ºC. Vanicek and Kramer (1969) determined that spawning occurred when temperatures reached 18ºC (mid-June to early July) in the Green River, and Marsh (1985) documented that hatching success was greatest in water temperature ranging from 15 to 20ºC. Bulkley et al. (1981) estimated the final thermal preferendum (i.e., optimum temperature for most physiological functions) of bonytail during their first year of life (25–50 mm) to be 24.2ºC.

Pimentel and Bulkley (1983) found that juvenile bonytail preferred concentrations of total dissolved solids (TDS) that range from 4,100 to 4,700 milligrams per liter (mg/L) and avoided concentrations less than 560 mg/L or greater than 6,600 mg/L. Preference for high TDS concentrations may decrease as fish get larger, and it may also suggest a habitat preference for warm, shallow backwaters where TDS concentrations are higher because of evaporation losses (Pimentel and Bulkley 1983). Bonytail preference for high TDS concentrations may have been a strategy to avoid predation by Colorado pikeminnow (Pimentel and Bulkley 1983).

Native Colorado River fishes may be at an advantage in swift and sometimes turbulent waters (Minckley 1973). Berry and Pimentel (1985) calculated swimming velocity for bonytail at three different velocities that ranged from 43 centimeters per second (cm/s) to 63 cm/s. These estimates represent sudden velocity increases that might be encountered by a fish entering a culvert or fish ladder (Berry and Pimentel 1985). Thus, recommended approach and screen-face velocities at intakes of about 15 cm/s do not exceed the swimming velocity that juvenile bonytail can maintain to avoid entrainment (Berry and Pimentel 1985).

The bonytail's diet comprises a wide variety of aquatic and terrestrial insects, worms, algae, plankton, and plant debris (Pacey and Marsh 1998; Mueller and Marsh 2002; Marsh et al. 2013). Bonytail larger than 7.9 inches collected from the Green River had consumed terrestrial insects, plant debris, and filamentous algae (Vanicek and Kramer 1969). More quantitative descriptions of the bonytail's diet preferences are not available, including shifts in diet composition by life stage, except for information from bonytail stocked into Cibola High Levee Pond. This experimental population fed omnivorously, with adult bonytail consuming algae, vegetative material, small fish, and crayfish (*Procambarus* and *Orcopectes* spp.). Young bonytail were documented to feed near the surface of the pond, with a gut analysis demonstrating that smaller size classes typically fed on zooplankton and invertebrates (Mueller et al. 2003).

Population Status, Reasons for Decline, and Current Threats to Species Survival

Interactions between bonytail and introduced nonnative species have been recognized as one of the major factors contributing to the decline of this species (U.S. Fish and Wildlife Service 1990; Pacey and Marsh 1998). Bonytail have repeatedly exhibited successful spawning and recruitment in predator-free environments and, historically, maintained strong populations that coexisted with other native fi (Pacey and Marsh 1998; Mueller 2006). Jonez and Sumner (1954) observed common carp in the spawning area and indicate that these carp probably consumed most of the eggs. Channel catfish, largemouth bass, and other centrarchids, shad, and shiners probably feed on larvae or young juveniles. Predation by nonnative fish is devastating to bonytail during early life stages, and competition may negatively affect adults. Only the larger sized subadults have been able to survive when stocked into environments containing nonnative predators. There are currently no known populations of bonytail in the mainstem LCR; however, multiple small populations persist in off-channel habitats that are free on nonnative fish species.

Another contributor to the decline of bonytail populations is the impact of water resource development. The construction of dams has altered flow, temperature, cover, substrate, and other environmental conditions defining bonytail habitat. The dams themselves act as barriers to migration, population expansion, and larval drift. The unnatural (but often more stable) environmental conditions that are created by impoundments are often more conducive to introduced fish species. It is likely that interactions with nonnative fish and water resource management have worked synergistically to reduce bonytail populations.

The unnatural flow and temperature regimes resulting from impoundments have been credited with disrupting normal biological functions of native fish in the Upper Basin. Vanicek and Kramer (1969) found that the effects of Flaming Gorge Dam inhibit the spawning of native fish for more than 96 kilometers (60 miles) downstream. Reduced spring flows and increased flows from summer to winter result in a change of flow patterns, sediment loads, and water temperature (Muth et al. 2000). Growth rate of roundtail chub was also reportedly reduced. The change in flow and temperature regimes may also be responsible for interfering with factors governing reproductive isolation. Bonytail can hybridize with other members of the genus *Gila*. Collection and identification of hybrids in the Upper Basin suggest that the effects of water resource development may be increasing the occurrence of hybridization. Currently, bonytail in the Lower Basin are not found in riverine areas outside the LCR and have little or no exposure to other members of the genus *Gila*. However, if populations become established in other riverine portions of the Lower Basin, the previously discussed threats and limiting factors will apply to these populations. The only direct threats from water resource development in the Lower Basin currently are habitat loss from reservoir fluctuations and entrainment at hydropower facilities.

Management Needs and Recovery Goals

The immediate recovery goal for this species is to prevent its extinction. Quantifiable recovery goals for down listing and delisting were developed by the USFWS (U.S. Fish and Wildlife Service 2002).

The recovery goals for the bonytail relevant to the LCR require the establishment and maintenance of a genetic refugium and two self-sustaining populations. Eventually, off-channel areas should be reclaimed and stocked with bonytail and other native species. These areas should be secured from invasion of nonnative fish. Bonytail from these off-channel areas and hatcheries that attain a total length of 12 inches or more may be used to establish or augment populations that coexist with nonnative predators.

The LCR MSCP is addressing components of recovery through implementation of a Habitat Conservation Plan (HCP). The HCP describes the implementation strategy for conservation measures to aid in recovery of bonytail through habitat creation, the development of a genetic refugium, and augmentation stocking of up to 620,000 subadult fish into the LCR and its connective channels. The conservation measures associated with native fish augmentation were included in the HCP as part of the best practices for achieving successful conservation of native fishes in the LCR. Augmenting LCR fish populations embraces the strategy of replacing fish that are depleted due to natural mortality and high predation rates. Included in the augmentation total are goals to stock up to 200,000 bonytail into LCR MSCP River Reach 2 (Lake Mohave), 200,000 bonytail into River Reach 3 (Davis to Parker Dam), and 220,000 bonytail into River Reaches 4 and 5 (Parker to Imperial Dam). The demands for augmentation of this species can currently be met with the rearing capacity available to the program. Partner hatcheries and off-site rearing ponds have the annual capacity to produce 12,000–16,000 bonytail greater than 12 inches long for augmentation. The future annual demand for augmentation of this species is scheduled to increase, and the LCR MSCP is developing additional rearing capacity to meet this need.

Monitoring and research are required components of the HCP and are key elements of the LCR MSCP adaptive management program. The intent of monitoring and research is to provide information for the adaptive management process so that the LCR MSCP can improve its effectiveness and efficiency in fulfilling the conservation goals associated with the fish augmentation program as described in the HCP. Research and monitoring efforts for the fish augmentation program fall into three general focus areas: 1) determining key environmental correlates affecting growth and survival during rearing, 2) understanding and minimizing adverse effects of transporting and stocking, and 3) understanding post-stocking distribution and survival. Stocking the appropriate number of native fishes into the LCR allows for the augmentation goals of the HCP to be met; however, survival of these stocked fish is the simplest measure of conservation success. Survival rates are observed, recorded, and analyzed both during the rearing process and after fish are stocked. Regular monitoring through continuous sampling under the LCR MSCP will provide data on the populations of stocked fish. These data provide insight regarding the success of augmentation strategies and may alert resource agencies to new challenges in the future. These monitoring efforts are critical and, in some form, are expected to continue throughout the 50-year term of the LCR MSCP.

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I.1.1.6 Razorback Sucker (*Xyrauchen texanus)*

Legal Status

The razorback sucker is listed as endangered under the ESA and CESA and is Nevada State Endangered. Critical habitat has been designated for the razorback sucker and, within the Lower Colorado River Multi-Species Conservation Program (LCR MSCP) planning area, includes Lake Mead to its full-pool elevation; the river between Hoover Dam and Davis Dam, including Lake Mohave to its full-pool elevation; and the river and 100-year floodplain between Parker Dam and Imperial Dam.

Other Status

The razorback sucker is also:

- a G1 (global rank) and S1 (state rank) under the Arizona Natural Heritage Program,
- a wildlife species of special concern in Arizona,
- a G1 (global rank) and S1 (state rank) under the CNDDB,
- a G1 (global rank) and S1 (state rank) Nevada Natural Heritage Program, and
- a USFS sensitive species.

Species Distribution and Regionally Significant Populations in the LCR MSCP Planning Area

Historically, the razorback sucker inhabited the Colorado River and its tributaries from Wyoming to the Gulf of California. Razorback suckers were found in the Gila, Salt, and Verde Rivers, which are tributaries of the LCR. Upper Colorado River Basin (Upper Basin) tributaries containing populations of razorback suckers included the Gunnison River upstream to Delta, Colorado; the Green River from its confluence with the Colorado River upstream to the town of Green River, Wyoming (Vanicek et al. 1970); the Duchesne River (Tyus 1987); the lower White River near Ouray, Utah (Sigler and Miller 1963); the Little Snake River and lower Yampa River, Colorado (McAda and Wydoski 1980); and the San Juan River, New Mexico.
The current distribution of razorback suckers in the Upper Basin is confined to small groups of fish in several widely distributed locations. Most fish occur in the lower 4 miles of the Yampa River and the Green River from the mouth of the Yampa River downstream to the confluence with the Duchesne River (U.S. Fish and Wildlife Service [USFWS] 1998). Small populations may also occur in the Colorado River at Grand Valley and in the San Juan River upstream from Lake Powell.

Historically, the largest and most genetically diverse population of razorback suckers in the LCR MSCP planning area occurred in Lake Mohave. Smaller populations occurred in Lake Mead, the Colorado River below Davis Dam, and Senator Wash Reservoir (Bradford and Vlach 1995). Razorback suckers were also captured sporadically from the mainstem Colorado River, impoundments, and canals (Marsh and Minckley 1989). Valdez and Carothers (1998) indicated that a small population also existed in the Grand Canyon section of the Colorado River.

The razorback sucker population in Lake Mohave experienced considerable decline over the last 30 years. The Lake Mohave population was estimated to contain 60,000 individuals in 1988 (Minckley et al. 1991), but by the mid-1990s, less than 25,000 razorback suckers were thought to exist there (Marsh et al. 2003). This population continued to decline through the 1990s, and by 2001 it was estimated to contain fewer than 3,000 individuals (Marsh et al. 2003). Despite a declining population, razorback sucker spawning continued to be successful, and more than 20,000 wild razorback sucker larvae were collected in 1995 from Lake Mohave (Bureau of Reclamation 1996). Since that time, capture of wild-born larvae has continued on an annual basis, with 15,000–100,000 being captured each year for rearing at off-site facilities. Virtually no juvenile or adult recruitment has been detected in Lake Mohave; however, this population has been maintained through annual stockings.

Razorback suckers in the LCR are currently distributed between Lake Mead, Lake Mohave, the riverine reach between Davis Dam and Lake Havasu, and below Parker Dam. Combined data from 1990 to 1997 suggested that the total population of razorback suckers in Lake Mead during 1997 was between 400 and 450 individuals. Successful spawning has been identified at multiple locations in Lake Mead, and the occurrence of relatively young razorback suckers in recent surveys indicates that there may be low levels of natural recruitment in the lake. Recent population estimates indicate that this population has remained stable over the last 20 years. The Lake Mohave population has also remained stable in recent years and is currently estimated at 3,900 individuals (Miller et al. 2021). The population of razorback suckers between Davis Dam and Lake Havasu has responded well to augmentation efforts and is currently estimated at 4,864 individuals (Bullard et al. *in press*). The population of razorback suckers below Parker Dam has increased in recent years due to continued augmentation efforts and consistent data collection at two main spawning locations and is currently estimated at 935 individuals (Kelley et al. 2021).

Habitat Requirements and Special Considerations

Adult razorback sucker habitat requirements vary, depending on season and location. Adult razorback suckers are adapted for swimming in swift currents, but they may also be found in eddies and backwaters away from the main current (Allan and Roden 1978). Ryden and Pfeifer (1995) observed that subadult razorback suckers use eddies, pools, backwaters, and other slow-water areas during spring runoff and move into swifter main channel areas during summer. Tyus and Karp (1990) report that, during spring runoff, adults use flooded lowlands and areas of low velocity. Tyus (1987) indicates that midchannel sandbars represent a common summer habitat. Bradford et al. (1998) concludes that adult razorback suckers in the lower Imperial Division area of the Colorado River actively selected backwaters; however, many backwaters become unavailable to fish because of the effects of regulated flows. In clear reservoirs, adults are considered pelagic and can be found at various depths, except during the spawning period, when they use shallow shoreline areas.

Little is known about juvenile habitat requirements because very few juveniles have been captured in the wild. Larval razorback suckers have been observed using nearshore areas in Lake Mohave. In riverine environments, young razorback suckers use shorelines, embayments, and tributary mouths (Minckley et al. 1991).

Razorback suckers move upstream to spawning areas and then back downstream after spawning. Increasing water flows and water temperatures are the main factors influencing the onset of spawning migration (Tyus and Karp 1990; Modde and Irving 1998). In the Lower Basin reservoirs, spawning occurs from January to April/May (Langhorst and Marsh 1986). Water temperatures observed during spawning in the Upper and Lower Colorado River Basins are similar at peak spawning (10 and 15ºC), despite the differences in timing and magnitude of natural high flows (Tyus 1987; Tyus and Karp 1990). Spawning success suggests that increase rates of discharge are not needed to successfully reproduce, but that they are important in small, genetically isolated populations to initiate movement of adults to spawning locations (Modde and Irving 1998).

During the spawning season, adult razorback sucker migrations have been documented in Lake Mohave, the Green River, the Middle Green River, and the lower Yampa River (Marsh and Minckley 1989; Tyus 1987; Modde and Irving 1998). Razorback sucker adults have demonstrated fidelity for spawning locations (Tyus and Karp 1990). Spawning in lakes and streams takes place over loosely packed gravel or cobble substrate in reaches with velocities less than 4.9 feet per second (Bradford and Vlach 1995).

Downstream movement of razorback following spawning may be associated with feeding behavior (Tyus and Karp 1990). Razorback suckers may use wetland outlets and tributary mouths because of preferred temperature ranges or higher productivity (Modde and Irving

1998).The preferred temperature range of the adult razorback sucker is 22.9–24.8ºC (Bulkley and Pimentel 1983). Estimates of upper and lower avoidance temperatures were from 27.4 to 31.6ºC and from 8.0 to 14.7ºC, respectively. These results indicated that low summer water temperature may have contributed to the disappearance of razorback sucker from the tailwaters of Flaming Gorge Reservoir on the Green River, Utah, (Bulkley and Pimentel 1983) because water temperatures were well below the lower avoidance temperatures. Bulkley and Pimentel (1983) recommended summer water temperatures between 22 and 25ºC to provide suitable habitat for this species.

The razorback sucker is an omnivorous bottom feeder. Its diet depends on location and life stage (Bradford and Vlach 1995; Valdez and Carothers 1998). Larval razorback suckers were reported to feed on diatoms, rotifers, algae, and detritus (Wydoski and Wick 1998). Stomach contents of adult individuals collected in the riverine environment consist of algae and dipteran larvae, and adults examined from Lake Mohave were found to feed primarily on planktonic crustaceans (Minckley 1973).

Population Status, Reasons for Decline, and Current Threats to Species Survival

Like many fish native to the LCR, the razorback sucker has evolved to survive and flourish in large rivers in the presence of other native fish. If historical conditions were to return to the Lower Basin, razorback sucker populations would likely respond positively. Water resource development and interactions with nonnative fish species currently threaten the razorback sucker (Pacey and Marsh 1998). The limiting factors resulting from these two major threats include altered temperature and flow regimes, habitat loss, habitat fragmentation, predation, competition, and increased risk of disease and parasitism. Populations in the LCR have persisted largely as a result of augmentation stockings, but the limiting factors in the system continue to reduce the likelihood of developing self-sustaining populations.

The primary limiting factor for razorback suckers in the Lower Basin is probably the direct effect of predation on early life stages by nonnative fish (Johnson 1999; Pacey and Marsh 1998; Marsh et al. 2005; Mueller 2006; Mueller and Carpenter 2008). Although several nonnative species prey on razorback sucker eggs or larvae, little work has been done to measure the direct effect of predation. Johnson (1999) demonstrated in a laboratory experiment that green sunfish can consume more than 99% of razorback sucker larvae in clear water. In Lake Mohave, similar clear water conditions exist, and predation on razorback sucker larvae by juvenile bluegills and green sunfish has been demonstrated using molecular techniques (Ehlo et al. 2017). Minckley et al. (1991) suggest that the best evidence related to the effects of predation is that successful spawning and recruitment are commonly reported from predator-free environments. Spawning occurs in lakes Mead and Mohave, and many eggs survive and become larvae. However, few larvae, if any, survive to the subadult stage. During the past few decades, the population dynamics of razorback suckers at different locations in the Lower Basin have exhibited similar trends. Adult fish were observed in each population; however, juveniles were rare. Although wild populations of razorback suckers have been observed spawning in various locations in the Lower Basin, recruitment has never been successful enough to replenish the adult populations. Eventually, the adult fish die of old age, and populations become reduced or extirpated. The lack of recruitment in these populations is thought to be primarily a result of predation by nonnative fish on early life stages.

Impoundments in the LCR represent another major threat to razorback suckers. The unnatural flow regimes created by impoundments may inhibit spawning and reduce growth of razorback suckers. Daily fluctuations in the river may result in mortality from fish stranded in flooded areas.

Another limiting factor that is directly related to the flow regime is loss of habitat. The comparatively stable flows that occur downstream of impoundments during the spring and early summer do not allow the river to flood and maintain low-lying areas. Historically, high spring and summer flows created large backwater and off-channel areas that may have been important habitat for early life stages of razorback suckers. Dams and impoundments also act as barriers to larval drift, species expansion, and migration.

Management Needs and Recovery Goals

The short-term recovery goal for this species is to prevent its extinction. Quantifiable recovery goals for down listing and delisting were developed by the USFWS (USFWS 2002).

The recovery goals for the razorback sucker relevant to the LCR require the establishment and maintenance of a genetic refugium and two self-sustaining populations. The recovery plan for the razorback sucker lists the following specific management needs to ensure recovery of this species:

- Maintain existing genetic diversity in hatchery refugia and increase diversity if possible;
- Reverse the decline of this species and increase and stabilize existing populations in Lake Mohave, the middle Green River, Yampa River, and lower Green River by management actions;
- Protect the habitats of these populations from further degradation;
- Restore habitats to make them compatible with recovery goals;
- Augment or reestablish populations of the fish in its critical habitat (USFWS 1998).

The LCR MSCP is addressing components of recovery through implementation of a Habitat Conservation Plan (HCP). The HCP describes the implementation strategy for conservation measures to aid in recovery of razorback sucker through habitat creation, the development of a genetic refugium, and augmentation stocking of up to 660,000 subadult fish into the LCR and its connective channels. The conservation measures associated with native fish augmentation were included in the HCP as part of the best practices for achieving successful conservation of native fishes in the LCR. Augmenting LCR fish populations embraces the strategy of replacing fish that are depleted due to natural mortality and high predation rates. Included in the augmentation total are goals to stock up to 330,000 razorback suckers into LCR MSCP River Reach 3 (Davis to Parker Dam) and 330,000 razorback suckers into River Reaches 4 and 5 (Parker to Imperial Dam). The demands for augmentation of this species can currently be met with the rearing capacity available to the program. Partner hatcheries and off-site rearing ponds have the annual capacity to produce approximately 20,000 razorback suckers greater than 12 inches long for augmentation. The future annual demand for augmentation of this species is scheduled to increase, and the LCR MSCP is developing additional rearing capacity to meet this need.

Monitoring and research are required components of the HCP and are key elements of the LCR MSCP adaptive management program. The intent of monitoring and research is to provide information for the adaptive management process so that the LCR MSCP can improve its effectiveness and efficiency in fulfilling the conservation goals associated with the fish augmentation program as described in the HCP. Research and monitoring efforts for the fish augmentation program fall into three general focus areas: 1) determining key environmental correlates affecting growth and survival during rearing, 2) understanding and minimizing adverse effects of transporting and stocking, and 3) understanding post-stocking distribution and survival. Stocking the appropriate number of native fishes into the LCR allows for the augmentation goals of the HCP to be met; however, survival of these stocked fish is the simplest measure of conservation success. Survival rates are observed, recorded, and analyzed both during the rearing process and after fish are stocked. Regular monitoring through continuous sampling under the LCR MSCP, as well as annual interagency sampling efforts, will provide data on the populations of stocked fish. These data provide insight regarding the success of augmentation strategies and may alert resource agencies to new challenges in the future. These monitoring efforts are critical and, in some form, are expected to continue throughout the 50-year term of the LCR MSCP.

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I.1.1.7 Northern Mexican Gartersnake (*Thamnophis eques megalops*)

Legal Status

The northern Mexican gartersnake is a subspecies of the Mexican gartersnake (*Thamnophis eques*); the only subspecies that occurs in the United States and is listed as a Threatened species under the ESA (USFWS 2013a). The USFWS designated critical habitat for this species on May 28, 2021 (USFWS 2021).

Other Status

- G4T3 (global rank) in NatureServe and 1A (state rank) in the Arizona Heritage Data Management System.
- A wildlife species of special concern in Arizona
- Not listed in the CNDDB (there are apparently no records of this species from the California counties along the Colorado River)
- Not listed in the Nevada Natural Heritage Program. It is noted as a historic species.

Species Distribution

At the time the LCR MSCP was established in 2005, the northern Mexican gartersnake was considered extirpated from the area surrounding the mainstem of the LCR and had not been considered as a potential covered species. The species was re-documented in 2012 below Alamo Dam on the Bill Williams River and later in its largest tributaries. In 2015, it was documented on the Havasu National Wildlife Refuge within Beal Lake Conservation Area in Mohave County, Arizona.

Arizona Game and Fish Department (AGFD) conducted surveys for the Colorado River toad (*Bufo alvarius*) and the lowland leopard frog (*Rana yavapaiensis*) in potential habitat within the LCR MSCP planning area from south of Davis Dam to the Southerly International Boundary and the Bill Williams River from east of Planet Ranch west to the confluence with Lake Havasu from 2011-2013 (Cotten 2011; Cotten and Grandmaison 2012). Lentic (of, relating of, or living in still waters such as lakes, ponds, or swamps) and lotic (of, relating to, or living in actively moving water) backwaters and desert washes that appeared to provide suitable habitat for the toad and frog were surveyed using funnel trap arrays, visual encounter surveys, and nocturnal audio surveys (Cotten 2011; Cotten and Grandmaison 2012). During these surveys, ten northern Mexican gartersnakes were captured in funnel traps along the Bill Williams River upstream of Planet Ranch in 2012 (Cotten 2011; Cotten and Grandmaison 2012).

The northern Mexican gartersnake can be secretive and difficult to detect especially if present in low densities (Emmons and Nowak 2013; Cotten pers. comm.). The surveys from 2011-2013 were targeted for the frog and toad, not the northern Mexican gartersnake; methods, trap placement, location, and timing would be different depending upon the targeted species (Cotten pers. comm.).

In the spring of 2015, the LCR MSCP was notified by Great Basin Bird Observatory that they may have sighted a northern Mexican gartersnake at Beal Lake Conservation Area on the Havasu National Wildlife Refuge in Arizona during riparian bird monitoring. The AGFD, USFWS, and U.S. Geological Survey (USGS) were notified, and five photographs were provided for identification. A gartersnake was observed on May 4, 2015, in the same area and two additional photographs were taken for identification. The USFWS notified the LCR MSCP on June 1, 2015, that the species was confirmed as a northern Mexican gartersnake by Taylor Cotten and Tom Jones of AGFD and Jeff Servoss of the USFWS.

Northern Mexican gartersnake distribution and abundance within the Beal Lake Conservation Area is not well known at this time. The detections in 2015 were on a road in the cottonwood-willow riparian habitat at Beal Lake Conservation Area adjacent to the Willow Marsh phase. In 2019, USFWS conducted a study at six sites in Havasu National Wildlife Refuge within Topock Marsh and Beal Lake Conservation Area and detected 15 individual northern Mexican gartersnakes, 7 at Beal Lake Conservation Area in Willow Marsh, and 8 at the Glory Hole site on Topock Marsh. Captures included males and females and 2 juveniles.

Species presence and absence in other areas of the LCR is still unknown as species specific surveys have not been conducted. No sightings have been recorded, likely due to the cryptic nature of the species. The LCR MSCP has reviewed the existing literature and coordinated with biologists knowledgeable of the species to predict the potential for encountering gartersnakes based on the habitat type and species preferences. It is also important to note that due to the mild winter temperatures in the area (rarely below freezing for long periods of time) and preliminary findings from telemetry research along the Verde River, the snakes may exhibit more surface activity than previously suspected and may be more active in the winter months along the LCR compared to other locations.

Habitat Requirements and Species Considerations

<u>Habitat</u>

In Arizona, Rosen and Schwalbe (1988) found that the most important habitat characteristics for the northern Mexican gartersnake were permanent water, dense bankline vegetation, and an abundance of prey species. Surveys and observations of northern Mexican gartersnakes in

Mexico suggested that dense vegetation is most important as protective cover where the gartersnake occurs with harmful nonnative species, but in largely or wholly native communities, vegetation density is much less important to survival (Burger 2007). Individuals often remain concealed under surface cover or subsurface in burrows and are found in areas with protected backwaters, braided side channels, beaver ponds, isolated pools near the main stem of the river, edges of dense emergent vegetation, dried up channels, ample downed and vegetative cover, and flooded areas (Emmons and Nowak 2013). Surveys in Mexico for the northern Mexican gartersnake found the species to be abundant in areas where habitat was severely degraded with no or low vegetation cover but had few or no harmful nonnative species present and maintained a suitable native prey base, suggesting that in the absence of harmful nonnative species, dense vegetation is less important in maintaining healthy gartersnake populations (Burger 2007; Servoss pers. comm.). While actively foraging, studies have shown that northern Mexican gartersnakes usually stay within 15 meters of a water source (a direct function of preferred prey) but will move farther away on occasion for gestation, periods of dormancy, ecdysis (shedding) cycles, etc. (Rosen and Schwalbe 1988). They have been observed from over 500 feet (Emmons 2014) to over one mile away (Cogan pers. comm.) from the water for sheltering purposes, foraging on land, and moving to other water sources or hibernation sites (Nowak et al. 2011; Rosen and Schwalbe 1988; USFWS 2013).

Sheltering Habitat

Northern Mexican gartersnakes take shelter or cover in dense herbaceous vegetation, dense emergent vegetation, holes, root crevices, submergent vegetation, debris dams, downed logs or trees, rocky areas or rock piles, animal burrows, and man-made cover such as riprap or debris piles (Conant 2003; Emmons and Nowak 2013; Nowak et al. 2011; Rosen and Schwalbe 1988; Cotten pers. comm.). The presence of small diameter trees provides additional habitat complexity, thermoregulatory opportunities, and cover for the northern Mexican gartersnake (USFWS 2014).

Habitat Used During Prolonged Inactivity

The northern Mexican gartersnake will use areas of cover with optimal thermal requirements for cover during periods of prolonged inactivity (Cotten pers. comm.). Steep hills, riverbanks, upland burrows, and cliffs adjacent to riparian areas near permanent water sources can provide such areas for the species (Nowak et al. 2011). Individuals will also use small mammal burrows, packrat middens, debris piles, flood debris drifts, rock piles, and retaining wall riprap (Cotten pers. comm.).

Diet

Potential prey along the main stem of the LCR include the Woodhouse's toad (*Anaxyrus woodhousii*), Pacific tree frog (*Hyliola regilla*), invertebrates, lizards, and small mammals (Cotten 2011; Cotten and Grandmaison 2012; Rorabaugh et al. 2004). Potential prey species found along the Bill Williams River are the Arizona toad (*Anaxyrus microschaphus*), red-spotted toad (*Anaxyrus punctatus*), longfin dace (*Agosia chrysogaster*), invertebrates, lizards, and small mammals (Cotten 2011; Cotten and Grandmaison 2012). Small size classes of harmful nonnative fish may also be used as prey including largemouth bass (*Micropterus* sp.), black bullheads (*Ameiurus melas*), and American bullfrogs (*Lithobates catesbeianus*) (Emmons and Nowak 2016b).

<u>Breeding</u>

Exact timing of breeding events varies with elevation (Rosen and Schwalbe 1988). Mating occurs in fall and spring, and females store the sperm until ovulation in late March or early April (Rosen and Schwalbe 1988). Northern Mexican gartersnake females give birth to live young from late May through early July (Brennan and Holycross 2006; Rosen and Schwalbe 1988; Wallace 2002). Manjarrez (1998) noticed that births were positively correlated with temperature.

Females can have up to 38 young during one breeding season (Nowak and Boyarski 2012) and the size of the litter is positively correlated with the length of the female (Manjarrez 1998; Rosen and Schwalbe 1988). Female northern Mexican gartersnakes have been found to bear young in warm microenvironments 5 to 15 meters from the water, using rock walls, the ground, and sun-warmed sacaton tussocks (Rosen and Schwalbe 1988), but may give birth in a variety of microhabitats and distances from water. The breeding season in this area is estimated to occur between March and July (March-May mating; May-August live birth).

<u>Behavior</u>

The northern Mexican gartersnake is considered a terrestrial and aquatic generalist (USFWS 2013). The northern Mexican gartersnake is active during the warmer months of the year; they are the most active from May to September (Degenhardt et al. 1996; Emmons and Nowak 2013; Manjarrez 1998), but surface activity patterns may depend heavily on elevation and climate, with longer windows of activity at lower elevations. Northern Mexican gartersnakes will bask on any substrate, natural or artificial, including on reeds, stones, the ground, and rocks (Rosen 1991; Conant 2003).

The northern Mexican gartersnake forages along watercourses and seeks shelter in thick streamside vegetation (Degenhardt et al. 1996), burrows, under debris, rocks, etc. The northern Mexican gartersnake was observed demonstrating a wide variety of foraging methods including ambushing prey in water and on land, active foraging in riffles, vegetation mats, grass, and open water, and feeding in areas where there are temporary concentrations of prey (Rosen and Schwalbe 1988). The Mexican gartersnake, including the northern subspecies, primarily forages along the shoreline of the water source but occasionally dives in water, forages away from the shoreline, and forages on the pond’s surface (Drummond and Garcia 1989). Mexican gartersnakes have been observed hanging from holes between the rocks with their head in the water and catching fish as they swam by (Conant 2003 page 16).

The northern Mexican gartersnake can be difficult to detect due to their secretive nature, their ability to quickly escape underwater, and their ability to persist in low population densities (USFWS 2013). Additionally, the northern Mexican gartersnake coexists with other species of gartersnakes across their distribution (Rosen and Schwalbe 1988; Tanner 1959).

Regionally Significant Populations in the LCR MSCP Planning Area

All populations of northern Mexican gartersnakes on the LCR are considered regionally significant. The population on the Havasu National Wildlife Refuge at Topock Marsh and Beal Lake Conservation Area is the only one known to exist along the mainstem. The only other populations connected to the watershed are those along the Bill Williams River and its tributaries the Big Sandy and Santa Maria Rivers. These areas were proposed as critical habitat by the USFWS in 2020 (USFWS 2020) and met the criteria for designation. The proposed critical habitat units within the LCR MSCP planning area and off-site mitigation areas were excluded from designation (USFWS 2021) due to the inclusion of the northern Mexican gartersnake as a covered species under the LCR MSCP, the commitment to implement conservation for the species for the term of the permit, and the combined success of conservation efforts of the LCR MSCP and other land managers to create and manage habitat that benefits the northern Mexican gartersnake and other native aquatic and riparian-dependent species.

Population Status and Reasons for Decline

The population is listed under the ESA as Threatened. Reductions in range and population densities have affected the status of the northern Mexican gartersnake significantly in the last 30 years. The subspecies occurs at low to very low population densities or may even be extirpated in as much as 90 percent of the northern Mexican gartersnake's historical distribution in the United States. As of 2016, there were only five northern Mexican gartersnake populations in the United States where the subspecies remains reliably detected and is considered viable, and all are in Arizona. The five known populations are: (1) The Page Springs and Bubbling Ponds State Fish Hatcheries along Oak Creek; (2) lower Tonto Creek; (3) the upper Santa Cruz River in the San Rafael Valley; (4) the Bill Williams River; and (5) the upper and middle Verde River. As many as 23 of 33 known northern Mexican gartersnake localities in the United States (70 percent) are likely not viable and may exist at low population densities that could be threatened with extirpation or may already be extirpated. (Servoss pers. comm.)

Northern Mexican gartersnake populations have declined primarily from interactions with harmful nonnative species such as bullfrogs, crayfish, and predatory fish. These nonnative species prey upon or compete with the gartersnakes and the native prey species that are vital to their existence. Human activities that diminish surface water or degrade streamside (riparian) vegetation are also significant threats, but particularly where they co-occur in the presence of nonnative species (USFWS 2014).

Current Threats to Species Survival

The presence of harmful nonnative species constitutes the most significant threat to the gartersnake. Harmful nonnative species directly prey upon the gartersnake and compete with them for prey. Landscape-level effects from the continued expansion of harmful nonnative species have changed the spatial orientation of the gartersnakes' distribution, creating greater isolation between populations. The prey base of these gartersnakes includes native amphibians and fish populations. Declines in their prey base have led to subsequent declines in the distribution and density of gartersnake populations. In most areas across their range, prey base declines are largely attributed to the introduction and expansion of harmful nonnative species (USFWS 2014).

Human activities that diminish surface water or degrade streamside (riparian) vegetation urbanization and road construction and use are also significant threats, but particularly where they co-occur in the presence of nonnative species (USFWS 2014).

Management Needs

The creation or restoration of marshes for Yuma clapper rail and creation of cottonwood-willow habitat for southwestern willow flycatcher will benefit the northern Mexican gartersnake. Marsh associated with backwaters that are disconnected from the LCR channel are of higher value to northern Mexican gartersnake than connected backwaters on the LCR and are the preferred type to achieve LCR MSCP conservation goals for this species. Marsh associated with disconnected backwaters are managed to limit non-native predatory species, to the extent practicable.

Existing Management Actions

Conservation measure NMGS1 states that 512 acres of marsh will be created to provide northern Mexican gartersnake habitat. This created habitat will also be habitat for the Yuma clapper rail (HCP conservation measure CLRA1). Of the 5,940 acres of LCR MSCP-created cottonwood-willow I-IV, 984 acres will be created and managed near marshes to provide northern Mexican gartersnake habitat. Conservation measure NMGS2 provides for implementation of measures to avoid or minimize take of the northern Mexican gartersnake as provided through LCR MSCP best management practices. These practices will be developed in coordination with the USFWS and may include measures addressing worker education programs, speed limits, seasonal restrictions, backfilling or covering trenches overnight, and effects of non-native species. Avoidance and minimization measures AMM1, AMM2, AMM4, AMM5, and AMM6 outlined in the HCP would also apply to the gartersnake. These measures are ongoing and will be implemented to benefit the northern Mexican gartersnake, except where implementation would negatively affect other covered species. Since the measures are beneficial to all the covered species, there may be temporary negative impacts that rise to the level of take, but overall will benefit the northern Mexican gartersnake. In addition, monitoring and research measure MRM2 would also apply.

The AGFD's conservation and mitigation program (CAMP; implemented under an existing section 7 incidental take permit) has committed to either stocking (with captive-bred stock) or securing two populations each of northern Mexican and narrow-headed gartersnakes to help minimize adverse effects to these species from their sport fish stocking program through 2021 (USFWS 2011, Appendix C). Other CAMP commitments include: (1) Developing a gartersnake monitoring, research, and restocking plan to guide CAMP activities to establish or secure populations; (2) developing outreach material to reduce the deliberate killing or injuring of gartersnakes (placed in high angler access areas); (3) ensuring that chemically renovated streams are quickly restocked with native fish as gartersnake prey; (4) conducting a live bait assessment team to develop recommendations to amend live bait management; (5) reviewing and updating outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species; (6) developing and implementing a public education program on gartersnakes; and (7) working with the New Mexico Department of Game and Fish to examine the roll of escaped rainbow trout from Luna Lake into tributaries to the San Francisco River in supporting narrow-headed gartersnakes.

Recovery Goals

The recovery plan for the northern Mexican gartersnake has not yet been prepared; there are no agency-mandated recovery goals for the northern Mexican gartersnake at this time.

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Other Threatened and Endangered Species and Effects

Other Threatened and Endangered Species	Reason For No Effect From Increased Reduction In Flow Reach 3
Southwestern willow flycatcher *Empidonax traillii extimus*	The original LCR MSCP analysis assumed the loss of all cottonwood-willow land cover; therefore, no additional impacts are anticipated beyond those already assessed.
Desert Tortoise *Gopherus agassizii*	Is not affected by flow related covered activities.
Humpback chub *Gila cypha*	The original LCR MSCP mitigated for impacts to Humpback chub in Lake Mead from full pool elevation down to water surface elevation 950 ft. Water surface elevation changes from this incremental analysis would be within that range.
Yellow-billed cuckoo *Coccyzus americanus occidentalis*	The original LCR MSCP analysis assumed the loss of all cottonwood-willow land cover; therefore, no additional impacts are anticipated beyond those already assessed.

Attachment 4

Other LCR MSCP Reaches and Effects

Lake Mead Reservoir (Reach 1)

The LCR MSCP included the effects of the future flow related covered activities, including reductions in flow, on Lake Mead water surface elevations from full pool down to a water surface elevation of 950 ft. This analysis shows that increasing the reduction in flow in Reaches 2 and 3 would increase reservoir storage in Lake Mead above baseline conditions. Because high and low reservoir fluctuations would still occur, the increase in flow reductions would not have an effect above the effects already analyzed in the original LCR MSCP.

River Conditions Parker Dam to Imperial Dam (Reaches 4 and 5) and Imperial Dam to Morelos Dam (Reach 6)

Increasing reductions in flow below Hoover Dam and Davis Dam (Reaches 2 and 3) would not impact river flows between Parker Dam and Imperial Dam (Reaches 4 and 5). The 2004 LCR MSCP analyzed effects of flow reductions up to 1,574,000 afy between Parker and Imperial Dams. The proposed action would not reduce flows below those analyzed in the 2004 LCR MSCP.

The LCR MSCP did not specifically account for flow reductions between Imperial Dam and Morelos Dam (Reach 6) because hydrologic impacts of the future flow-related actions were determined to be insignificant. River flows in Reach 6 are dominated by drainage return flows and not releases from upstream reservoirs. Most of the Colorado River water delivered to Morelos Dam is diverted at Imperial Dam, routed through the All- American Canal, then returned to the river through either Siphon Drop or Pilot Knob power plants, which are located upstream from Morelos Dam.

The lower end of Reach 6, from Siphon Drop downstream to Morelos Dam, is characterized by steep banks leading into desert vegetation, developed areas, or areas completely denuded of vegetation. Riparian and marsh habitat is non-existent to the extent needed to support LCR MSCP terrestrial species. Native fish habitat in the lower portion of Reach 6 of the Colorado River has been degraded due to a variety of human influences and non-native fish presence. Field surveys conducted for game fish have not detected the presence of razorback sucker or bonytail. Increases in reductions in flow between Hoover and Parker Dams (Reaches 2 and 3) would have no effect on LCR MSCP species in Reach 6.

Beneficial Flows past Morelos Dam – Limitrophe (Reach 7)

The LCR MSCP included the effects of the covered activities on beneficial flows arriving at Morelos Dam. Beneficial flows were defined as flows exceeding 250k afy in excess of Mexico's water order arriving at Morelos Dam. The original LCR MSCP analysis determined that there would be no significant effects on beneficial flows below Morelos Dam as a result of LCR

MSCP covered activities (BA Section 5.2.2 and Appendix L). Because beneficial flows below Morelos are a function of surplus and flood control conditions in Lake Mead, the slight increase in reservoir storage due to increasing reduction in flow in Reaches 2 and 3 would not change this analysis.

Attachment 5

Impacts on Four Threatened and Endangered Species

5.5.1 Yuma Clapper Rail

Implementation of the increased reduction in flow and conservation measures is likely to adversely affect the Yuma clapper rail. Implementation of the increased reduction in flow and proposed conservation measures could affect a proportion of Yuma clapper rail habitat throughout its present range over the term of the LCR MSCP. The effects of the increased reduction in flow and conservation measures on the distribution and status of the Yuma clapper will be minimized through implementation of avoidance and minimization measures listed in the 2004 LCR MSCP HCP and creation of habitat to replace affected habitat. Creation of habitat in addition to that required to replace lost habitat, through implementation of the conservation measures, is expected to result in beneficial effects by contributing to recovery of the Yuma clapper rail.

5.5.1.1 Effects of Increased Reduction in Flow

Increased reduction in flow may result in take of the Yuma clapper rail. Changes in points of diversion in Reach 3 will lower groundwater levels sufficiently in this reach to reduce the extent or quality of 7 acres of Yuma clapper rail habitat provided by marshes associated with backwaters. Lowering groundwater elevations could cause direct loss of these habitats by desiccating, fragmenting, or reducing the extent of habitat patches.

Reservoir elevations in Reach 3 would not be affected by lower river stage elevations. Consequently, increased reduction in flow is not expected to affect habitat associated with marshes maintained by reservoirs (Bill Williams Delta). The LCR MSCP will avoid the potential effects of lowering groundwater elevations on an additional 16 acres of habitat at Topock Marsh by maintaining water deliveries to Topock Marsh, thereby maintaining water levels and existing habitat conditions.

5.5.1.3 Effects of Conservation Measure Implementation

Activities associated with creating and maintaining backwaters and marsh as habitat for threatened and endangered species in existing Yuma clapper rail habitat may result in take of Yuma clapper rail. Habitat creation–related activities could result in temporary disturbance of habitat and harassment of individuals if they are present at the time activities are implemented. In the 2004 LCR MSCP HCP, Permittees were required to create or protect two acres of Yuma clapper rail habitat for every acre affected by covered actions and activities. To offset impacts to 7 acres of Yuma clapper rail habitat, Reclamation would create and manage or protect up to 15 acres of existing, degraded, or former marsh that may convert low-value habitat to fully functioning marsh that provides high-value Yuma clapper rail habitat. Some additional limited and low-value habitat (such as dry patches of herbaceous vegetation near marsh edges) could be converted to habitat to benefit other threatened and endangered species; however, with implementation of the avoidance and minimization measures described in the 2004 LCR MSCP HCP, removal of these low-quality habitats is not expected to result in harm (i.e., injury or mortality of individuals) and, therefore, is not expected to result in take of Yuma clapper rail.

Habitat management–related activities, such as operating equipment to remove vegetation and maintain open water in backwaters and burning decadent marsh vegetation to stimulate vegetation growth, could result in temporary loss of habitat and harassment of individuals. To the extent practicable, these activities would be conducted when nesting adults and young birds are not present, to avoid injury or mortality. Removing habitat to establish habitat for other LCR MSCP covered species would be avoided. The maximum extent of habitat that could be affected by habitat management activities is estimated to be 15 acres (the extent of marsh land cover to be created and managed as habitat for associated threatened and endangered species) over the term of the LCR MSCP. The likelihood of take is expected to increase over the term of the LCR MSCP if the abundance of Yuma clapper rail increases in the LCR MSCP planning area as a result of implementing conservation measures for this species. The level of adverse effects on habitats and individuals will depend on the type and extent of habitat management activities undertaken in species habitat.

Implementation of the conservation measure will create 15 acres of Yuma clapper rail habitat to replace habitat that could be lost as a result of the increased reduction in flow.

5.5.1.4. Effects to Critical Habitat

No critical habitat has been designated for Yuma Ridgway's rail; therefore, none will be affected by the proposed action.

5.5.4 Bonytail

Implementation of the increased reduction in flow and conservation measures would affect flows and water levels in a proportion of bonytail habitat along the LCR (i.e., Reach 3). The degree to which changes in flow reductions would affect the future distribution and status of bonytail in Reach 3 compared to existing conditions is uncertain. Conservation measures to replace affected bonytail habitat will fully mitigate effects to habitat and contribute to recovery of the species. Implementation of the increased reduction in flow and conservation measures is likely to adversely affect the bonytail. Implementation of the increased reduction in flow and conservation measures could impact bonytail critical habitat. These impacts are not expected to appreciably diminish the value of critical habitat for species conservation because impacted acres are less than 1% of the existing bonytail habitat in Reach 3 (15 out of 23,745 acres or 0.06%).

5.5.4.1 Effects of Increased Reduction in Flow

Increased reduction in flow may result in take of bonytail. Changes in flow in Reach 3 would result in the loss of 15 acres of habitat between the northern boundary of Havasu NWR and Lake Havasu.

Implementation of increased reduction in flow would reduce river flow in Reach 3. Consequently, although river operations related to hydropower generation will not change (see LCR MSCP BA Section 5.2.1.3), the range of high and low flows will be lower than under existing conditions. Changes to the water elevations below Davis Dam (Reach 3) are depicted in Table 1. These changes differ seasonally and range between –0.60 feet and –0.03 feet at Davis Dam. The pattern of fluctuations does not change, and once reduced flows are implemented, no additional changes to elevations would be expected. The result of these changes is not substantial as related to existing conditions evaluated in the 2004 LCR MSCP analysis (Table 1). The change in the potential for stranding and desiccation, therefore, is expected to be minimal. Implementing the increased reduction in flow would reduce river depth during the spawning period. The lower depth could reduce potential spawning habitat area. Bonytail prefer backwaters and occupy pools and eddies away from strong currents (Pimentel and Bulkley 1983; Vanicek 1967). Backwaters are warmer and more productive than the main river channel, potentially supporting faster growth rates. In addition, backwaters with emergent vegetation provide cover and refuge from predators. Reduced flow, and the consequent shallower depth, could reduce rearing habitat area in the river and backwaters.
Based on known entrainment of razorback suckers in water diversions (Bureau of Reclamation 1996), it is assumed reductions in flow in Reach 3 may similarly entrain bonytail. Entrainment of bonytail under implementation of the reduction in flow will be similar to existing conditions (based on the area with measurable velocity toward the diversion intake); however, any entrainment of bonytail could affect the population because of its low population numbers.

5.5.4.3 Effects of Conservation Measure Implementation

Construction-related activities associated with establishing and managing created species habitat in Reach 3 may result in take of bonytail. Adverse effects of habitat construction and maintenance activities on bonytail would be temporary, generally occurring during the period of construction. Habitat creation–related construction and maintenance activities may:

- cause juvenile and adult fish to temporarily avoid using affected habitat;
- increase turbidity and cause sedimentation of spawning and rearing habitat, which could suffocate eggs and larvae and temporarily reduce the production and availability of food organisms; and
- accidentally discharge contaminants or resuspend contaminants from disturbed sediments, which could adversely affect the survival, growth, and reproduction of bonytail.

Although construction and maintenance activities could adversely affect bonytail and its habitat, the extent of habitat disturbed would be small, the disturbance would be temporary, and the effects would be minimal.

Implementation of the additional conservation measures, including creation of 15 acres of backwater habitat, will fully mitigate effects of the increased reduction in flow.

5.5.4.4 Effects on Critical Habitat

In 1994, the USFWS proposed critical habitat for the bonytail. Designated critical habitat for bonytail in the LCR MSCP planning area consists of:

- the Colorado River from Hoover Dam to Davis Dam, including Lake Mohave up to its full-pool elevation (i.e., Reach 2); and
- the Colorado River from the northern boundary of Havasu NWR to Parker Dam, including Lake Havasu up to its full-pool elevation (i.e., Reach 3).

Implementation of increased reduction in flow would not affect environmental conditions in Reach 2, including Lake Mohave. Therefore, critical habitat in Reach 2 would not be affected. Increased reduction in flow would affect environmental conditions in Reach 3, by changing river flow in the segment upstream of Lake Havasu and changing diversion in Lake Havasu, which would result in the loss of 7 acres of habitat. Implementation of conservation measures could also affect environmental conditions in Reach 3 but is not expected to result in the loss of habitat.

Effects on critical habitat for the bonytail are confined to Reach 3 from the upper end of Lake Havasu to the upper end of Havasu NWR. Lake Havasu operations are not expected to change with the implementation of the increased reduction in flow. Implementation of increased reduction in flow would reduce river depth during the spawning period. The reduced depth could affect primary constituent elements by reducing potential spawning habitat area and associated backwaters. Bonytail prefer backwaters and occupy pools and eddies away from strong currents (Pimentel and Bulkley 1983; Vanicek 1967). Backwaters are warmer and more productive than the main river channel, potentially supporting faster growth rates. In addition, backwaters with emergent vegetation provide cover and potential refuges from predators. Reduced flow, and subsequent shallower depth, could reduce rearing habitat area in the river and backwaters. Reduced flow may also increase stranding losses where daily flow variability isolates and subsequently desiccates occupied habitat. Increasing stranding relative to the existing conditions depends on site-specific channel morphology and the relationship of reduced depth in association with ongoing daily flow fluctuation. Although the increased reduction in flow may have impacts on bonytail critical habitat, the factor limiting the abundance of bonytail and other LCR native fish species are competition from non-native fish species and predation by non-native fish species and piscivorous birds. Effects on bonytail critical habitat and predation are not expected to increase the threat from competition from non-native fish species. The possibility, therefore, of impacts on critical habitat resulting from the increased reduction in flow is not expected to appreciably diminish the value of critical habitat for species' conservation, affect the survival of the species, nor appreciably diminish the value of critical habitat for survival of the species, for the following reasons:

- The LCR MSCP includes conservation measures specific to constructing or managing critical habitat for the bonytail within its designated critical habitat. The created habitat within designated critical habitat will be managed to provide higher value for the bonytail than the affected critical habitat it will replace (e.g., the habitat will be maintained free of nonnative competitors/predator fishes to the greatest extent practicable).
- The implementation of the increased reduction in flow and the conservation measures will not diminish capacity of bonytail critical habitat present within the LCR MSCP

planning area to a level that will preclude future achievement of the razorback sucker recovery goals (U.S. Fish and Wildlife Service 2002c)

- The LCR MSCP provides for the continued adaptive management of conservation measures to ensure that implementation of the increased reduction in flow will not diminish the value of critical habitat for conservation.
- The survival of bonytail will not be compromised by the possible effects on critical habitat resulting from increased reduction in flow because the construction and management of backwaters within designated critical habitat to provide high value bonytail habitat will replace the value of affected habitat.

5.5.6 Razorback Sucker

Implementation of the increased reduction in flow and conservation measures could affect razorback sucker habitat in a proportion of habitat in Reach 3. The degree to which changes in flow reductions would affect the future distribution and status of razorback sucker in Reach 3 compared to existing conditions is uncertain. Conservation measures to replace affected razorback sucker habitat will fully mitigate effects to habitat and contribute to the recovery of the species. Implementation of the increased reduction in flow and conservation measures is likely to adversely affect the razorback sucker.

5.5.6.1 Effects of Increased Reduction in Flow

The increased reduction in flows may result in take of razorback sucker. The increased reduction in flow in Reach 3 would result in the loss of 15 acres of habitat.

Razorback suckers require clean gravel in shallow areas of quiet water for spawning from January through April/May (Langhorst and Marsh 1986). Implementing increased reduction in flow would reduce river depth during the spawning period. The reduced depth could reduce potential spawning habitat area. Connected backwaters and low-velocity channel types, such as pool edges and side channels, provide rearing habitat for larval and juvenile razorback sucker. Stocked razorback suckers show a preference for backwaters over the main channel habitats (Gurtin and Bradford 2000). Backwaters are warmer and more productive than the main river channel, potentially supporting faster growth rates. In addition, backwaters with emergent vegetation provide cover and refuge from predators. Reduced flow, and the resulting shallower depth, could reduce rearing habitat area in the river and backwaters.

Implementation of the increased reductions in flow would reduce river flow. Consequently, although river operations related to hydropower generation will not change (see LCR MSCP BA Section 5.2.1.3), the range of high and low flows will be lower than under existing conditions. Changes to the water elevations below Davis Dam (Reach 3) are depicted in Table 1. These changes differ seasonally and range between –0.60 feet and –0.03 feet at Davis Dam. The pattern of fluctuations does not change, and once reduced flows are implemented, no additional changes to elevations would be expected. The result of these changes is not substantial as related to existing conditions. The change in the potential for stranding and desiccation, therefore, is expected to be minimal.

5.5.6.3 Effects of Conservation Measure Implementation

Construction-related activities associated with establishing and managing created species habitat in Reach 3 may result in take of razorback sucker. Adverse effects of habitat construction and maintenance activities on razorback sucker would be temporary, generally occurring during the period of construction. Habitat creation–related construction and maintenance activities may:

- cause juvenile and adult fish to temporarily avoid using affected habitat;
- disturb substrate and cause sedimentation of spawning and rearing habitat, which could suffocate eggs and larvae and temporarily reduce the local production and availability of food organisms; and
- accidentally discharge contaminants or resuspend contaminants from disturbed sediments, which could adversely affect the survival, growth, and reproduction of razorback sucker.

Although construction and maintenance activities could adversely affect the razorback sucker and its habitat, the extent of habitat disturbed would be small, the disturbance would be temporary, and the effects would be minimal.

Implementation of the additional conservation measures, including creation of 15 acres of backwater habitat, will fully mitigate effects of the increased reduction in flow.

5.5.6.4 Effects on Critical Habitat

In 1994, the USFWS proposed critical habitat for the razorback sucker. Designated critical habitat for razorback sucker in the LCR MSCP planning area consists of:

- Lake Mead up to its full-pool elevation (i.e., Reach 1);
- the Colorado River and its 100-year floodplain from Hoover Dam to Davis Dam, including Lake Mohave up to its full-pool elevation (i.e., Reach 2); and
- the Colorado River and its 100-year floodplain from Parker Dam to Imperial Dam, including Imperial Reservoir to the full-pool elevation or 100-year floodplain, whichever is greater (i.e., Reaches 4 and 5).

Implementation of the increased reduction in flow s would not affect environmental conditions in Reach 1 beyond what was analyzed in the LCR MSCP. Implementation of the increased reductions in flow would not affect environmental conditions in Reach 2, including Lake Mohave. Therefore, critical habitat in Reach 2 would not be affected.

5.5.28 Northern Mexican Gartersnake

Implementation of the increased reduction in flow and conservation measures is likely to adversely affect the northern Mexican gartersnake. The potential effects of implementing increased reduction in flow and conservation measures in Reach 3 on the range-wide distribution and status of the northern Mexican gartersnake are expected to be minor, affecting a relatively small number of individuals and proportion of its habitat over the term of the LCR MSCP.

General conservation measures listed in the 2004 LCR MSCP HCP will avoid and minimize direct effects of implementing the reduction in flow and habitat creation conservation measures on the northern Mexican gartersnake. The potential effects of habitat loss is expected to be minimized with the creation of replacement habitat.

5.5.28.1 Effects of Flow-Related Covered Activities

Increased reduction in flow may result in take of the northern Mexican gartersnake. Changes in points of diversion in Reach 3 will lower groundwater levels sufficiently in these reaches to reduce the extent of 7 acres of habitat provided by marshes associated with backwaters. Lowering groundwater elevations could cause direct loss of these habitats through desiccation, fragmentation, or reduction in the extent of habitat patches.

Additional effects to adjacent cottonwood-willow would not occur as all cottonwood-willow land cover was mitigated for as part of the LCR MSCP. Reservoir elevations in Reach 3 would not be affected by lower river stage elevations. Consequently, the increased reduction in flow is not expected to affect habitat associated with marshes maintained by reservoirs (e.g., Bill Williams Delta - Reach 3). Through implementation of AMM2, the LCR MSCP will avoid potential effects of lowering groundwater elevations on an additional 149 (16 acres of marsh and a maximum of 133 acres of cottonwood willow) acres of habitat at Topock Marsh by maintaining water deliveries to Topock Marsh for maintenance of water levels and existing habitat conditions.

5.5.28.3 Effects of Conservation Measure Implementation

Activities associated with creating and maintaining habitat for threatened and endangered species may result in take of the northern Mexican gartersnake. Habitat creation-related activities could result in temporary disturbance of habitat and harassment of individuals if they are present at the time activities are implemented, but these activities will avoid removal of primary habitat to establish habitat for other covered species.

In the 2018 Biological Opinion that amended the 2004 LCR MSCP HCP to include the northern Mexican gartersnake as a covered species, the Permittees were required to create or protect two acres of marsh habitat for every acre affected by covered actions and activities. To offset impacts to 7 acres of northern Mexican gartersnake habitat, Reclamation would create, manage, or protect up to 15 acres to fully functioning marsh that provides high-value northern Mexican gartersnake habitat. Some additional limited and low-value habitat (such as dry patches of herbaceous vegetation near marsh edges) could be converted to habitat to benefit other threatened and endangered species; however, with implementation of the avoidance and minimization measures described in the 2017 LCR MSCP HCP Amendment, removal of these low-quality habitats is not expected to result in harm (i.e., injury or mortality of individuals) and, therefore, is not expected to result in take of northern Mexican gartersnake.

Habitat management-related activities, such as operation of equipment to remove vegetation and maintain open water in backwaters, burning decadent marsh vegetation to stimulate vegetation growth, periodic removal of trees in patches of created habitat to encourage stand regeneration, and operation of equipment to maintain roads, could result in temporary loss of habitat and harassment, injury, or mortality of individuals. The maximum extent of habitat that could be affected by habitat management activities is estimated to be 15 acres (i.e., the extent of marsh land cover to be created as habitat for associated threatened and endangered species) over the term of the LCR MSCP. The likelihood for take is expected to increase over the term of the LCR MSCP if the abundance of the northern Mexican gartersnake increases in the LCR MSCP planning area as a result of implementing conservation measures for this species. The level of adverse effects on habitats and individuals will depend on the type and extent of habitat management activities that are undertaken in species habitat.

5.5.28.4 Effects on Proposed Critical Habitat

On April 28, 2021, the USFWS designated critical habitat designation for the northern Mexican gartersnake. Critical habitat included the Bill Williams River in Arizona (Bill Williams River Unit) within the LCR MSCP implementation area between Alamo Dam and the confluence of the Colorado River and Bill Williams River. The increased reduction in flow and conservation measures will have no effect on this critical habitat as they occur outside the boundaries.

Attachment 6

Conservation Measures for Four Threatened and Endangered Species

5.7.1 Yuma Clapper Rail

5.7.1.1 Summary of Effects

Implementation of increased reduction in flow and conservation measures could result in the loss of up to 7 acres of Yuma clapper rail habitat and take of individuals. Some additional limited and low-value habitat (e.g., dry patches of herbaceous vegetation near marsh edges) could be affected by habitat creation and maintenance activities; however, the level of take is assumed to be low because of the limited value of the potentially affected habitat.

5.7.1.2 Conservation Measures[9]

The following Conservation Measures are new and will be implemented as a result of the proposed action.

CLRA1-1—Create, monitor, and adaptively manage 15 acres of Yuma clapper rail habitat. Create, monitor, and adaptively manage 15 acres of marsh to provide Yuma clapper rail habitat. This created habitat will also provide habitat for the northern Mexican gartersnake. Habitat will be created in patches as large as possible but will not be created in patches smaller than 5 acres. Smaller patches are likely to support isolated nesting pairs and be within the range of habitat patch sizes used by the species for foraging and dispersal. Larger patches would be expected to support multiple nesting pairs. Additional Yuma clapper rail habitat may be provided by marsh vegetation that becomes established along margins of the 15 acres of backwaters that will be created in Reaches 3. These small patches of habitat would provide cover for dispersing rails, thereby facilitating linkages between existing breeding populations and the colonization of created habitats.

Yuma clapper rail habitat will be created and maintained as described in 2004 LCR MSCP BA Section 5.4.3.3. Marshes created to provide Yuma clapper rail habitat will be designed and managed to provide an integrated mosaic of wetland vegetation types, water depths, and open water areas. Within this mosaic of marsh conditions, Yuma clapper rail habitat will generally be provided by patches of bulrush and cattails interspersed with small patches of open water with water levels maintained at depths appropriate for this species. Created marsh habitat will generally be managed to provide for gradual fluctuations in water level during Yuma clapper rail breeding season (March – June).

Existing general conservation measures AMM1, AMM2, AMM3, AMM5, MRM1, MRM2, MRM5, CMM1, and CMM2 in the LCR MSCP HCP will also mitigate for effects of the increased reduction in flow (2004 LCR MSCP HCP; Section 5.6).

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[9] Minor Modification to language in CLRA-1 was approved by the Steering Committee 4-22-2020 (Final Motion20-003 FinalPDD20-002). Minor Modification was approved by the FWS in letter dated 5-21-2020.

5.7.1.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the conservation measures, including the creation of 15 acres of habitat, achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of increased reduction in flow and conservation measures implementation on the Yuma clapper rail, and to contribute to its recovery. Implementation of these measures will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of fully replacing affected habitat. Implementation of the conservation measures will also contribute to recovery by increasing the amount of new breeding habitat by 8 acres, in addition to replacing the extent of affected habitat.

5.7.4 Bonytail

5.7.4.1 Summary of Effects

Implementation of increased reduction in flow and conservation measures could result in the loss of up to 15 acres of bonytail habitat, stranding, and desiccation losses in the river and connected backwaters.

5.7.4.2 Conservation Measures

BONY2-1—Create, monitor, and adaptively manage 15 acres of bonytail habitat. Create 15 acres of backwater with depth, vegetation, and substrate characteristics that provide the elements of bonytail habitat. This created backwater will also provide habitat for the razorback sucker. Created backwaters will be designed and managed as described in 2004 LCR MSCP BA Section 5.4.3.4. At a minimum, created backwaters will contain the physical, chemical, and biological conditions suitable for the establishment and maintenance of healthy fish populations in the LCR.

Existing general conservation measures AMM1, AMM4, AMM5, AMM6, MRM1, MRM2, and MRM5 in the LCR MSCP HCP will also mitigate for effects of the increased reduction in flow (2004 LCR MSCP HCP; Section 5.6).

5.7.4.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the conservation measures, including creation of 15 acres of habitat, achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of increased reduction in flow and conservation measure implementation on the bonytail, and contribute to its recovery. Implementation of these measures will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of replacing affected habitat and will contribute to attainment of the recovery goals established for the species (U.S. Fish and Wildlife Service 2002c).

5.7.6 Razorback Sucker

5.7.6.1 Summary of Effects

Implementation of increased reduction in flow and conservation measures could result in the loss of up to 15 acres of razorback sucker habitat, stranding and desiccation losses in the river and connected backwaters.

5.7.6.2 Conservation Measures

RASU2-1—Create, monitor, and adaptively manage 15 acres of razorback sucker habitat. Create 15 acres of backwater with water depth, vegetation, and substrate characteristics that provide the elements of razorback sucker habitat. This created backwater will also provide habitat for the bonytail. Created backwaters will be designed and managed as described in the LCR MSCP BA Section 5.4.3.4. At a minimum, created backwaters will contain the physical, chemical, and biological conditions suitable for the establishment and maintenance of healthy fish populations in the LCR.

Existing general conservation measures AMM1, AMM4, AMM5, AMM6, MRM1, MRM2, and MRM5 in the LCR MSCP HCP will also mitigate for effects of the increased reduction in flow (2004 LCR MSCP HCP; Section 5.6).

5.7.6.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the conservation measures, including creation of 15 acres of habitat, achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of increased reduction in flow and conservation measure implementation on the razorback sucker, and contribute to its recovery. Implementation of these measures will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of replacing affected habitat and will contribute to attainment of the recovery goals established for the species (U.S. Fish and Wildlife Service 2002e).

5.7.28 Northern Mexican Gartersnake[10]

5.7.28.1 Summary of Effects

Implementation of increased reduction in flow and conservation measures could result in the loss of up to 7 acres of northern Mexican gartersnake habitat and take of individuals. Some additional limited and low-value habitat (e.g., dry patches of herbaceous vegetation near marsh edges) could be affected by habitat creation and maintenance activities; however, the level of take is assumed to be low because of the limited value of the potentially affected habitat.

[10] Northern Mexican gartersnake added as a covered species, HCP amendment approved by the Steering Committee 6-28-2017, Section 10 Permit amended by USFWS 3-5-2018.

5.7.28.2 Conservation Measures

NMGS1-1—Create 15 acres of northern Mexican gartersnake habitat. Create and manage 15 acres of marsh to provide northern Mexican gartersnake habitat. This created habitat will also be habitat for the Yuma clapper rail. Newly created habitat will be located near existing conservation areas. Additional northern Mexican gartersnake habitat may be provided by marsh vegetation that becomes established along margins of 15 acres of backwaters that will be created. These small patches of habitat may provide linkages between existing habitat and may facilitate the colonization of created habitats. Marsh associated with backwaters that are disconnected from the LCR channel are of higher value to northern Mexican gartersnake than connected backwaters on the LCR and are the preferred type to achieve LCR MSCP conservation goals for this species. Marsh associated with disconnected backwaters are managed to limit non-native predatory species, to the extent practicable. The design and management criteria described in the conservation measures for Yuma clapper rail (LCR MSCP HCP Section 5.7.1), California black rail (LCR MSCP HCP Section 5.7.13), southwestern willow flycatcher (LCR MSCP HCP Section 5.7.2) and yellow-billed cuckoo (LCR MSCP HCP Section 5.7.14) will ensure that created cottonwood-willow and marsh areas will also provide other habitat requirements for this species.

Existing conservation measure NMGS2 and general conservation measures AMM1, AMM2, AMM4, AMM5, AMM6, and MRM2 in the LCR MSCP HCP will also mitigate for effects of the increased reduction in flow (2004 LCR MSCP HCP; Section 5.6).

5.7.28.3 Expected Outcomes with Implementation of Conservation Measures

Implementation of the conservation measures, including creation of 15 acres of habitat, achieves the LCR MSCP goal to avoid, minimize, and fully mitigate adverse effects of increased reduction in flow and conservation measure implementation on the northern Mexican gartersnake, and to contribute to its recovery. Implementation of these measures will help ensure that the existing abundance of the species in the LCR MSCP planning area is maintained as a result of fully replacing affected habitat. In addition, implementation of the conservation measures will benefit the northern Mexican gartersnake by increasing the amount of new habitat in the LCR MSCP planning area by 8 acres, in addition to replacing the extent of affected habitat.

Attachment 7

Summary of Effects

Table 7-1 below summarizes the potential effects of implementing the additional reduction in flow and conservation measures on threatened and endangered species. Reclamation's determinations in this Biological Assessment are based on applicable ESA regulations and USFWS Guidance. With respect to the "effects analysis" summarized in Table 7-1, Reclamation's analysis concludes that any effects resulting from proposed discretionary actions described in this Biological Assessment are not significant. However, Reclamation cannot conclude that isolated take of a single individual of a species will not occur, and the effects determinations have been made pursuant to this analysis (see discussion of potential take in the Endangered Species Consultation Handbook [U.S. Fish and Wildlife Service and National Marine Fisheries Service 1998, pg. 3–12]). Although, as described in Attachment 5 "Impacts on Four Threatened and Endangered Species", implementing the conservation measures (Attachment 6 and Attachment 7) may result in take of covered species, the net effects of implementing the conservation measures will be to avoid, minimize, and fully mitigate effects on the four threatened and endangered species.

Table 7-1.—Summary of Effects Analysis

Common And Scientific Name	Federal Status	No Effect	May Affect Not likely to Adversely Affect	May Affect Likely to Adversely Affect	May Affect Not Likely to Adversely Affect Critical Habitat	May Affect Likely to Adversely Affect Critical Habitat
Yuma clapper rail *Rallus longirostris yumanensis*	FE			X		
Southwestern willow flycatcher *Empidonax traillii extimus*	FE	X				
Desert tortoise (Mohave population) *Gopherus agassizii*	FT	X				
Bonytail *Gila elegans*	FE			X		X
Humpback chub *Gila cypha*	FT	X				
Razorback sucker *Xyrauchen texanus*	FE			X	X	
Yellow-billed cuckoo *Coccyzus americanus occidentalis*	FT	X				
Northern Mexican gartersnake *Thamnophis eques megalops*	FT			X		